SPECIAL: Experiments in Laying Bituminous Macadam

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Vol. XX. May, 1901. No. 5.

MUNICIPAL ENGINEERING

A MONTHLY MAGAZINE

DEVOTED TO THE IMPROVEMENT OF CITIES

PAVING, SEWERAGE, WATERWORKS, STREET LIGHTING, PARKS, STREET CLEANING, GARBAGE DISPOSAL, PUBLIC SANITATION, BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS AND NEW YORK.

LIBRARY OF CONGRESS
FEB 7 1902

Two Dollars Per Year. Single Copies, 25 Cents.

PRICE, 25 CENTS A NUMBER. $2.00 A YEAR.
FOREIGN SUBSCRIPTIONS, $2.75 A YEAR.

MUNICIPAL ENGINEERING.

PUBLISHED BY
MUNICIPAL ENGINEERING CO.
INDIANAPOLIS.
NEW YORK OFFICE, 1 BROADWAY.

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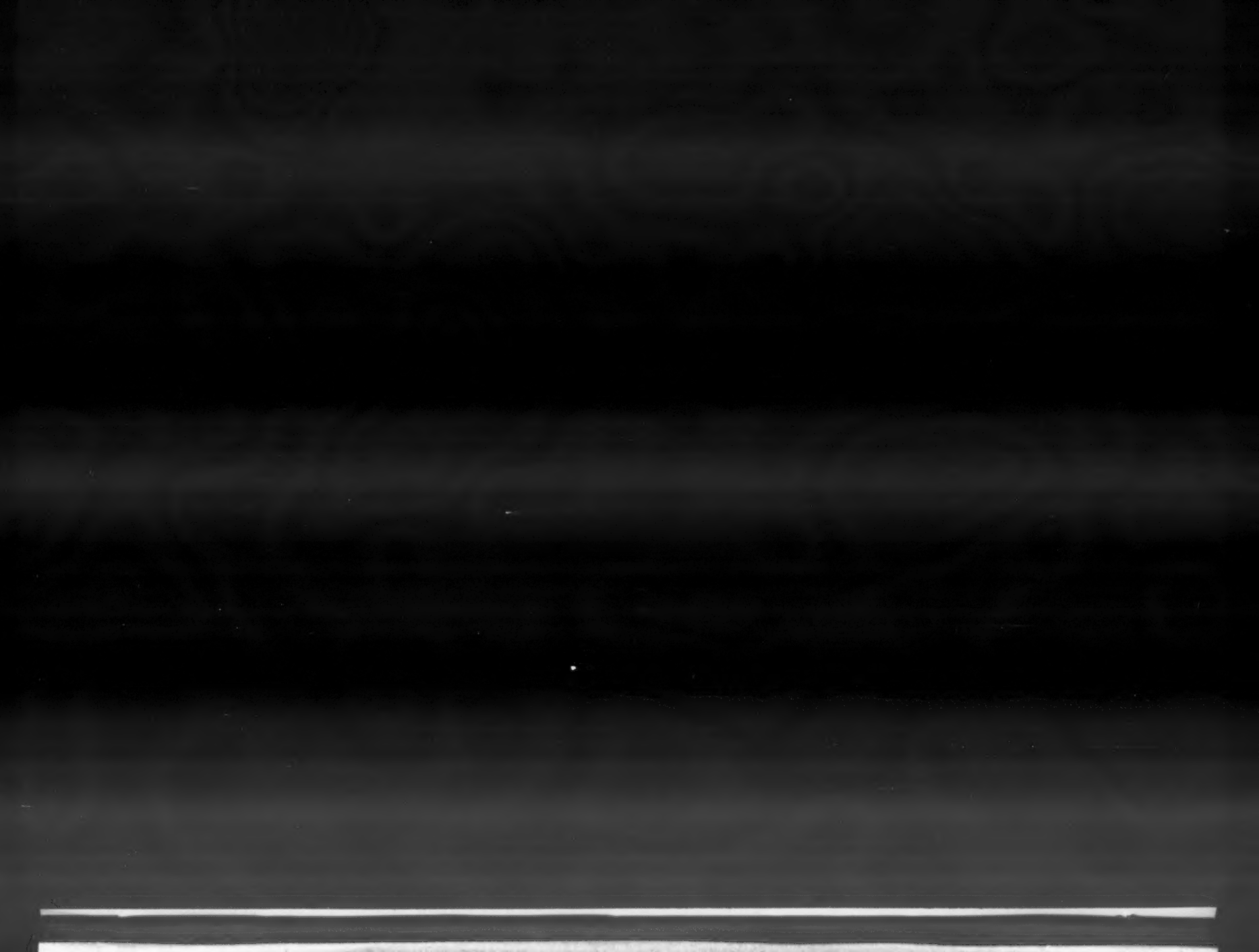
Entered at Post-Office, Indianapolis, Ind., as Second-Class Mail Matter.



Municipal Engineering

VOLUME XX. MAY, NINETEEN HUNDRED ONE. NUMBER 5.

MODERN METHODS OF SEWAGE PURIFICATION.

The sewerage commission of the state of Connecticut, in its recent annual report, discusses in considerable detail the methods of sewage purification which have been found within the past few years to be efficacious, and those which are now in process of development. Some of these are of direct application to the cities of that state, many of which must shortly take definite steps toward the removal of the nuisances which are produced by their present methods of sewage disposal.

The commission was appointed by the governor of the state in compliance with an act of the general assembly, and continues the work of a commission, operating the previous year under a former act. The business of the commission is definitely stated in these words:

"Section 2. Said commission shall investigate methods of sewage purification and construction of sewerage systems and sewage disposal works; and said commission shall have power to summon witnesses before it with books, papers and maps for any purpose that may appertain to the duties of said commission. The commission may employ from time to time the services of a competent bacteriologist, chemist or engineer, who shall be paid a reasonable compensation, approved by the board of control."

In accordance with these provisions three members of the commission visited England and inspected a number of the experimental stations and the new works completed or under construction, which are the result of the experiments which have been made so extensively in that country during the past five years or more.

The report gives some statement of some of these inspections, selections having been made of material which would be of most value for the local conditions in the state.

The committee visiting England seems to have been most favorably impressed with the results of the experiments at Manchester and reports upon them in considerable detail. These experiments lead to a program which includes screening, passage through a a septic tank, passage through contact beds, two in succession. The conclusions of the Manchester commission in charge of the work are given in full as the most definite and authoritative expression of the practical results of experimentation under Manchester conditions which has yet appeared.

"1. That the bacterial system is the system best adapted for the purification of the sewage of Manchester.

"2. That any doubts which may have arisen in the first instance as to its suitability, owing to the presence in Manchester sewage of much manufacturing refuse, have, through the convincing results of our experimental inquiry, been entirely banished.

"The results obtained have altogether exceeded our expectations as to the possibility of purifying a manufacturing sewage, inasmuch as it was previously a matter of common belief that in such a liquid only a most insignificant amount of nitrification could be induced.

"3. That inasmuch as a bacterial contact bed can only effect a definite amount of purification in a single contact, it becomes necessary, in order to carry the purification beyond this limit, to apply the effluent to a second bed, in which again a further definite amount of purification can be effected. Hence, for obtaining a high degree of efficiency of the bacterial purification of sewage, a system of multiple contact is generally necessary. Thus it may be taken broadly that in the first contact 50 per cent. of the dissolved impurity is removed, and that in the second contact 50 per cent. of the impurity still remaining in the effluent is disposed of and so on.

"4. In order that a bacterial contact bed may exercise its full powers of purification, it is necessary:

"(*a*) That it should be allowed sufficiently frequent and prolonged periods of rest.

"(*b*) That the sewage applied to it should, as far as possible, be free from suspended matters.

"(*c*) That the sewage applied to it should be of as uniform a character as possible.

"5. The above conditions are secured by passing the sewage as it arrives at the works through an adequate system of screens, catchpits, and tanks. Such an arrangement has the further important advantage of leading to the development of those anaerobic or septic processes which resolve into gaseous and soluble products the organic suspended matter present in the sewage. A large proportion of the sewage-sludge which would otherwise accumulate, and the disposal of which is the source of so much difficulty and expense, is thus abolished. The above anaerobic or septic process is found to take place as effectively in an open tank as in a closed one.

"6. The capacity of bacterial contact beds has been found to remain practically constant after they have been in operation for a period of three months. This capacity is best referred to the empty tanks, the measurement being taken to the line which corresponds to the surface of the clinkers which are subsequently put in. The constant water capacity of the beds has been found on this basis, in round numbers, to be about one-third of the tank capacity.

"7. With regard to the amount of sewage which can be purified by a given bed without the latter being overtaxed, our prolonged experimental inquiry has shown that each bed may safely receive four fillings in the twenty-four hours, provided the sewage has undergone the preliminary subsidence and septic preparation in tanks, and that the bed is accorded about one day's rest in every week. In the event of a bed having been unduly taxed, its efficiency is only temporarily impaired, and can be restored by a few days' repose.

"8. We have shown that storm water may also be satisfactorily dealt with by means of an accelerated bacterial treatment, which can be brought into operation

FIGURE 1. ACCRINGTON, ENGLAND. SEPTIC TANK, FULL.

as soon as the sewage is sufficiently dilute. As, however, until about two hours after the commencement of heavy rain there is no abatement in the concentration of the sewage, it will be generally necessary to provide for the storage or separate treatment of the first flow.

"9. Our experiments show that the bacterial system of treatment is efficacious at all seasons of the year, the temperature of the sewage being sufficient both to prevent any stoppage of the beds by the formation of ice, and also to maintain the necessary activity of the bacteria even in the coldest weather.

"In view of the experience gained and set forth above, we beg herewith to make the following recommendations:

"1. That the sewage as it arrives at the works be submitted to an efficient process of screening, and that it be then passed through the present open tanks. The tanks should be provided with submerged walls and floating scum-boards, so as to retard the flow of the mineral and organic matters in suspension.

"2. That the effluent from the open tanks be passed through the double contact beds.

"Of these double contact beds we estimate that there should be an area amounting in round numbers to sixty acres, exclusive of retaining walls, roads, etc. This estimate is based on a dry-weather flow of thirty millions, and that each acre, being laid out in beds of 3.33 feet depth, with four fillings per twenty-four hours, would be capable of dealing with half a million gallons of sewage in round numbers, allowing for one day per week rest. The bacteriological or biological beds would be constructed in pairs, high level and low level, of about half-an-acre each, for the purpose of being able to get the sewage quickly upon them.

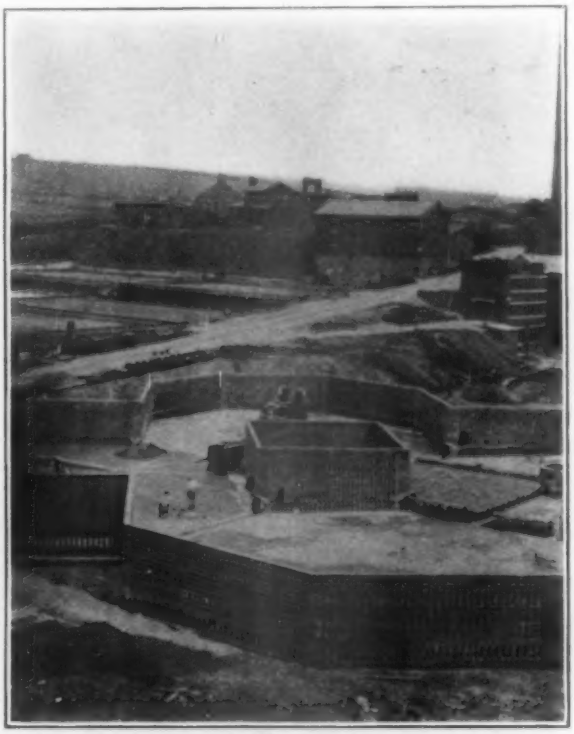


FIGURE 2. ACCRINGTON, ENGLAND. CONSTRUCTION OF CONTACT FILTER.

"3. With regard to the material most suitable for the bacteria beds, we should recommend that it consist of clinkers, of such a size as to pass a 1½ inch mesh and to be rejected by an ⅛ inch mesh. Efficient means must be provided for rapidly filling and discharging the beds. The beds should be so constructed as to allow of each being used independently.

"4. During the occurrence of a storm the

flow of sewage should be dealt with in the system of tanks and double contact beds. The excess of flow, after passing through the roughing tanks, should be taken to specially prepared bacteria beds of an area which, we provisionally estimate, will have to be at least twenty-five acres in extent.

"Finally, we may state our confident opinion that with the system of bacteriological treatment of the sewage of Manchester, set forth above, an effluent will be produced which will not only conform with

formerly in use proved to be totally inadequate to meet the demands of the local Government board, and has been displaced for septic tanks and contact filters. Some photographs of these works were procured by the committee and show details of construction and management better than descriptions can. Figure 1 shows the surface of the open septic tank through which the sewage flows after a thorough screening and in which nearly all the suspended organic matter is destroyed. The characteristic

FIGURE 3. ACCRINGTON, ENGLAND. CONTACT FILTERS, WITH SETTLING WELL AND EFFLUENT CHANNEL.

the Mersey and Irwell standard, but which will also materially improve the condition of the ship canal. Furthermore, as this system does away entirely with the use of chemicals, and at the same time to a very large extent reduces the volume of the sludge to be dealt with, it is obvious that much of the present expense will be saved by its adoption, and this saving may be taken as a material set-off against the cost of the construction of the proposed works."

The application of a similar program at Accrington is meeting with success. The process of chemical precipitation which was

heavy scum of the septic tank is shown, the cracks, giving the appearance of drying mud, being clearly shown in the picture. That it is not necessary to cover the tanks and exclude the light is shown by the successful working of this open tank. The climate of England is not so severe in winter as that of much of the United States, so that the effect of cold upon the action of the septic tank is much more pronounced in this country, and special methods of keeping up the bacterial action in winter may be necessary in some cases. From this septic tank the sewage flows to the contact filters.

Figure 2 shows one of these filters under construction. The open brick walls to support the coke used as filtering material, the drains and the floor are clearly shown. Figure 3 shows the filter full of coke and also the settling well and effluent channel. The plan of the filter is approximately a circle, to suit the patented method used for distributing the sewage over the bed. The effluent from the septic tank falls four or five feet in a thin sheet for aeration and is then raised by pulsometers and forced through the for some time. The effluent not being satisfactory, it is now run through a contact bed, the construction of which is shown in Figure 5. The floor is covered with tiles as shown, which are set so as to leave some inches of space below them. On these tiles the coke for the filter is spread. The effluent from the precipitation tanks flows by gravity through the pipes shown and out through holes in the top of the pipes, thus spraying the liquid over the surface of the coke.

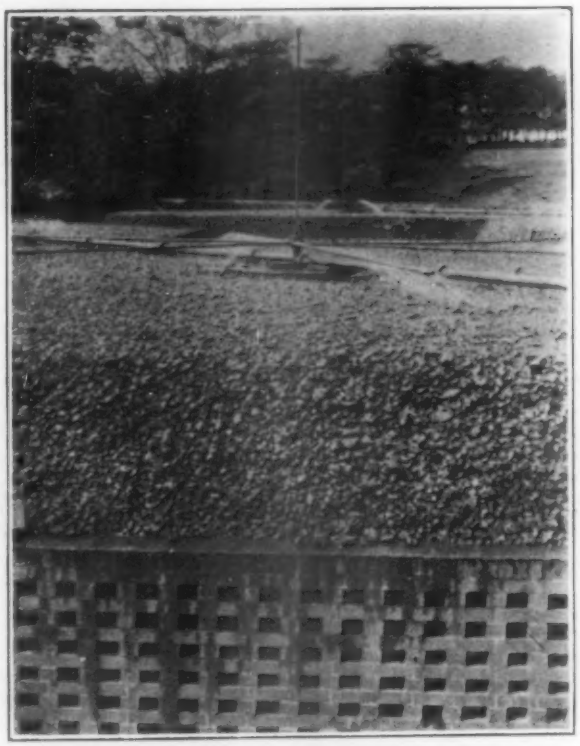


FIGURE 4. ACCRINGTON, ENGLAND. CONTACT FILTER IN OPERATION.

automatic revolving sprinkling device shown in Figure 4, which distributes the sewage uniformly and intermittently over the surface of the bed. The alternate filling and emptying of the contact bed is not necessary under this method of applying the sewage, and a single bed is sufficient. The sewage of Accrington is more concentrated than any other in England and consequently much more so than any in this country, but it seems to be taken care of by the process in use with entire satisfaction.

At Salford the sewage has been treated by the method of chemical precipitation

At Wimbledon the chemical precipitation process is also in use and the effluent is now further treated in a contact bed, a view of which is shown in Figure 6. The bed is very large and in the illustration is shown to be flooded. This bed is operated by the intermittent system described above for Manchester.

The summary of the conclusions of the Connecticut Sewerage Commission regarding sewage disposal and their general recommendations to Connecticut cities and towns will be found on page 223 of our April number. They are generally applicable to

many cities and towns throughout the country.

The commission has investigated the conditions in several cities of the state as a part of its duties under the statute and has responded to their requests for advice as to methods of procedure. The evident care taken and time consumed in the necessary investigations is evidence of the interest of the members of the board in their work and an earnest of the valuable service which it can give to the cities and towns of the state if supplied with sufficient funds to undertake the desired investigations and experiments and employ the necessary experts and assistants.

SOME EXPERIMENTS IN LAYING BITUMINOUS MACADAM.

The early success of so-called tar macadam pavement at Hamilton, Ontario, has been reported several times in the pages of MUNICIPAL ENGINEERING, and some statement of its use in various forms in other places has also appeared. Mr. Fred J. Warren's article last month on "Coal Tar for Paving Uses," discusses in some detail the reasons for believing that there is a basis for a material success in laying such pavements. The economic value of the project, if successful, lies in the fact that a good pavement for light traffic streets can be constructed on this general plan at a cost which will not be prohibitory even on streets where the property is of little value. The pavement will take a position intermediate between the gravel street and the hard pavement in cost, perhaps between the gravel and the ordinary well-constructed macadam pavement, and promises to be fully as durable as macadam and more satisfactory for most purposes on such light traffic streets than gravel or macadam on the one hand, or brick, asphalt or wood on the other, though for different reasons.

Mr. Warren considers that the city of Hamilton has made a mistake in separating the stone used into varying sizes, placing the larger sizes at the bottom and building up with progressively smaller sizes to the wearing surface, believing that the necessary dependence upon rolling and traffic to make a solid roadway, with the consequent grinding and displacement, will shorten the life of the pavement. The greater voids existing in the stone thus separated, also, according to his observation, shorten the life of the bituminous cement. According to his theory, therefore, the sizes of the particles of stone should be carefully graded and thoroughly mixed, to fill their own voids as fully as possible.

On the 9th of April some experimental sections of bituminous macadam roadway were laid under Mr. Warren's direction at the factory of Warren Brothers Co., in East Cambridge, in the presence and with the advice of fifty or sixty city engineers, street commissioners and officials of cities and towns in Massachusetts and other New England states.

These experiments were made under disadvantage in several respects, notably the wet weather on the day of the experiments and for several days previous, and the poor quality of stone obtainable at this season of the year, the plants in the vicinity being closed for the winter. The stone used was of a pudding stone variety from the Dorchester district and was not considered satisfactory by Mr. Warren. The theories upon which the plan for the construction was based were stated to be, that the subfoundation should be porous and furnish proper drainage, and that the depth of foundation could be reduced from that required in building macadam roads because the surface would be waterproof, and the amount of water to be taken care of by the foundation would be less than with more porous surfaces.

The roadway was built upon ground which had been filled about twenty feet within a few years over low ground containing much water. An excavation twelve inches deep was made, the bottom of which was not solid enough to carry a roller. Six inches of cinders was filled in and rolled with a fifteen-ton roller. On this was laid four inches of the broken pudding stone ranging in size from 1 inch to 2½ inches. This layer was rolled and the stone used was ground under the roller to a considerable extent owing to its character. The rain made all this construction very damp, and unfavorable for uniting with the bituminous concrete.

After rolling, the surface received a thin coat of a relatively soft bitumen whose trade name is chemical tar, all the light oils being removed. This coat was used because the stone was so cold and damp that it might not unite well with the coat of relatively hard pitch which was then sprinkled over the surface and was intended to bind the

stone firmly together and make a waterproof surface. The use of the intermediate chemical tar coat was intended to insure proper union under the unfavorable conditions of the day.

On top of this foundation was laid a binder or a wearing surface, nine different formulæ being used on various parts of the roadway. In most cases the binder course was left as the wearing surface. In one case stone two inches in diameter was used, progressively smaller sizes being used including a 15-ton roller before adding the bituminous top.

Various quantities of the bituminous cement were used in the various formulæ. Part of the area was surfaced with a thin layer of very soft bituminous sand concrete; part with a very thin and soft wearing surface using part stone screenings with the sand. These soft surfaces were laid ½ to 1 inch thick, and fine gravel, grit or stone chips were rolled into them until they became solid. A large part of the work had

FIGURE 5. SALFORD, ENGLAND. CONSTRUCTION OF FILTERS.

all sizes from 1 inch to 1-200 inch and about one per cent. of dust that would pass a 200 mesh screen. The mixture of these sizes reduced the voids in the stone down to 10 to 15 per cent. of the bulk before bitumen was added. In other cases the same mixture with 1½-inch stone as the largest size was used; in others 1-inch stone as the largest. In all cases the mixture of sizes was adhered to as essential to durability of bituminous matter and of pavement, the voids being reduced to the lowest per cent. possible with the facilities at hand. These layers were rolled with a 2½-ton and with no surface put on but was flushed over with a thick coat of a macadam composition into which fine grit was rolled, making an impervious top with a good foothold for horses.

This macadam composition was specially prepared from selected tar and refined with a view to removing as much of the naphthalene as possible, thus giving the bitumen as great a range of flexibility as can be secured. The composition used in all parts of the binder and wearing surface was so flexible that, in its pure state, it would run slowly from the 3-inch bunghole of a barrel.

Hardness of surface was acquired entirely by carefully grading the mineral grains, the theory being that all voids should be thoroughly filled with a slight surplus of permanent bitumen and that the bitumen should be so soft that it would, when confined in a carefully-selected stone, require twenty to forty years to reduce it, by natural processes, to a pitch of such hardness that it will crumble. Mr. Warren claims that the life of the roadway will be measured entirely by the amount of wear the stone

FIGURE 6. WIMBLETON, ENGLAND. COKE CONTACT FILTER FLOODED.

used will stand, when it is held in place firmly by the bituminous cement. The roadway, he claims, can be surfaced, from time to time, with a thin flush-coat, and in this way, life added to the exposed part, preventing it from becoming brittle.

If it is possible to confine a hard trap-rock in place with a flexible and water-proof bituminous cement and place the wear almost entirely on the stone, there is some ground for claiming that this form of roadway will be very durable.

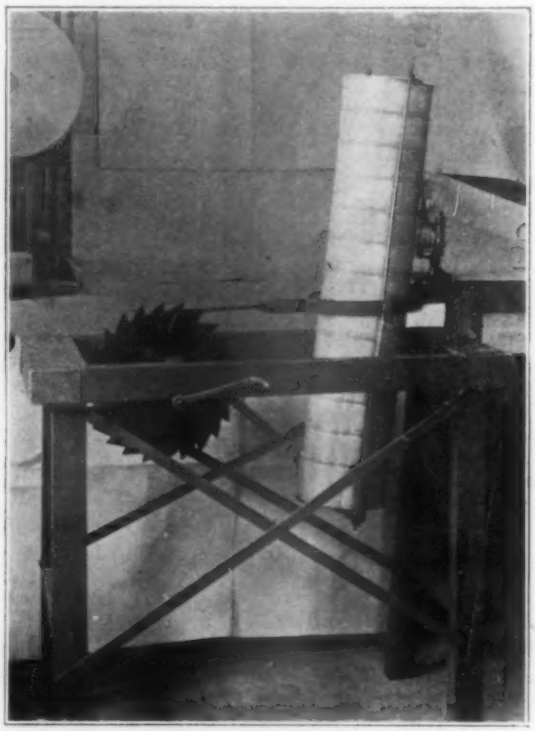
It is proper to say that the life of such work will probably depend, for light traffic streets, on the life of the bituminous materials used, but if Mr. Warren's statement is correct, that properly selected coal tar bituminous cements of about the grade and consistency used in the macadam have developed a life of forty years in some cases, then this form of pavement may have great economic value.

The question arises, will the large stones be displaced by horses' calks? Mr. Warren says if they are, use the mixture mentioned above as a permanent binder and keep it covered with a thin flexible and soft wearing surface, so soft that were it two inches thick it would cut all to pieces; by laying it only a quarter to one-half inch thick he claims it has not enough body to cut up and calks will only dent it. A flexible and fine grain bituminous surface, he claims, has been demonstrated to stand travel for many years and show practically no wear. The trouble in the past has been to unite a flexible surface to a hydraulic concrete base. The surface has pushed under traffic. With a bituminous base the surface unites to the base.

The machinery used was a paving plant

especially equipped for making sidewalk bituminous mastics. A Ruggles-Coles dryer that could pass no particle over 1 inch in diameter was used for heating. All larger sizes were therefore mixed in cold. An ordinary Dietz mixer, such as is used in asphalt plants, with a part of the teeth removed, was used for mixing and a steam jacket kettle for keeping warm the bituminous composition.

None of the material in the mixture was heated to a temperature over 200° F., and the work was based apparently received the approval of the practical road builders present and the outcome of the experiment will be watched with much interest. The attack of so interesting a problem as this in the manner described is worthy of attention, and whether the roadway is successful or not, the effort to reach the valuable truth in the theory is worthy of great commendation. Several of those present expressed their intention of laying some pavement on this plan during the year.



MECHANICAL SCREEN FOR MACADAM MATERIAL.

much of it was laid at as low temperatures as 125°.

The roadway was thrown open to teams on the next day, and is reported to stand the 20 or 25 heavy loads a day which pass over it without marking. Mr. Warren reports that a wagon loaded with 7,500 pounds of sand stood on the pavement in the sun for 30 minutes on the second day after it was laid, and the wheels made no impression.

This seems to be the first piece of pavement laid on the principle of using stone of predetermined variation of size and completely filling the voids, the stone being larger than ¼ inch. The principle on which

An interesting piece of apparatus devised to arrive at a quick result in determining the size of the grains of sand or stone is shown in the illustration accompanying. It will be recognized as a set of screens fastened together and arranged to be shaken by machinery. The screens are 1, ½, ¼, 1-10, 1-20, 1-30, 1-40, 1-50, 1-60, 1-80, 1-100, 1-200 inch in order. Assuming that any even-sized grain yields from 40 to 50 per cent. of voids, a result can be obtained by measure in ten minutes after taking sample. For most accurate determinations weights must be taken, which will prolong the operation about an hour. A stone properly graded for bituminous macadam, according

to Mr. Warren's theory, will increase in volume about 30 per cent. when separated into the varying sizes by the screens, 1,000 cubic inches becoming about 1,300 cubic inches.

CAMBRIDGE STREET WORK.

Under the efficient management of Charles A. Brown, the superintendent of streets, the streets of the city of Cambridge, Massachusetts, are being brought to good condition and are kept clean. A number of features new to the department have been adopted recently in methods of street cleaning with great advantage to the work and with complete satisfaction to the authorities. The accompanying illustration shows the types of machines in use. The first machine in the line is the gutter sweeper of the Automobile Street Sweeper Company, drawn by two horses moving at a fast walk. The brushes, placed vertically, are made to revolve rapidly and throw the dirt from the gutters into a windrow about three feet from the curb, the corners and sides of the gutters being cleaned as thoroughly as with a house broom. There being no weight of dirt to carry and no unloading, the machine is light and can move steadily along ahead of the pick-up machines which follow. These machines sweep a space seven feet wide and the dirt receptacle has a capacity of about one cubic yard. When filled it can be dumped either on the regular dump or on a side street, the pile of sweepings to be removed later in wagons. Four of these machines are in use. Three steel side sweeping machines have also been kept on duty night and day sweeping the paved streets. A very large item of expense has been the refilling of sweeping machine brooms. After mature consideration the street superintendent has come to the conclusion that this work can be done by the department at half the cost of the present method. The apparatus necessary will be ready for the summer's work and is expected to reduce this item of expense materially, the cost of this apparatus being very small. All the machines mentioned were purchased last year at a cost of $3,500, about ten per cent. of the entire amount paid out on account of cleaning streets.

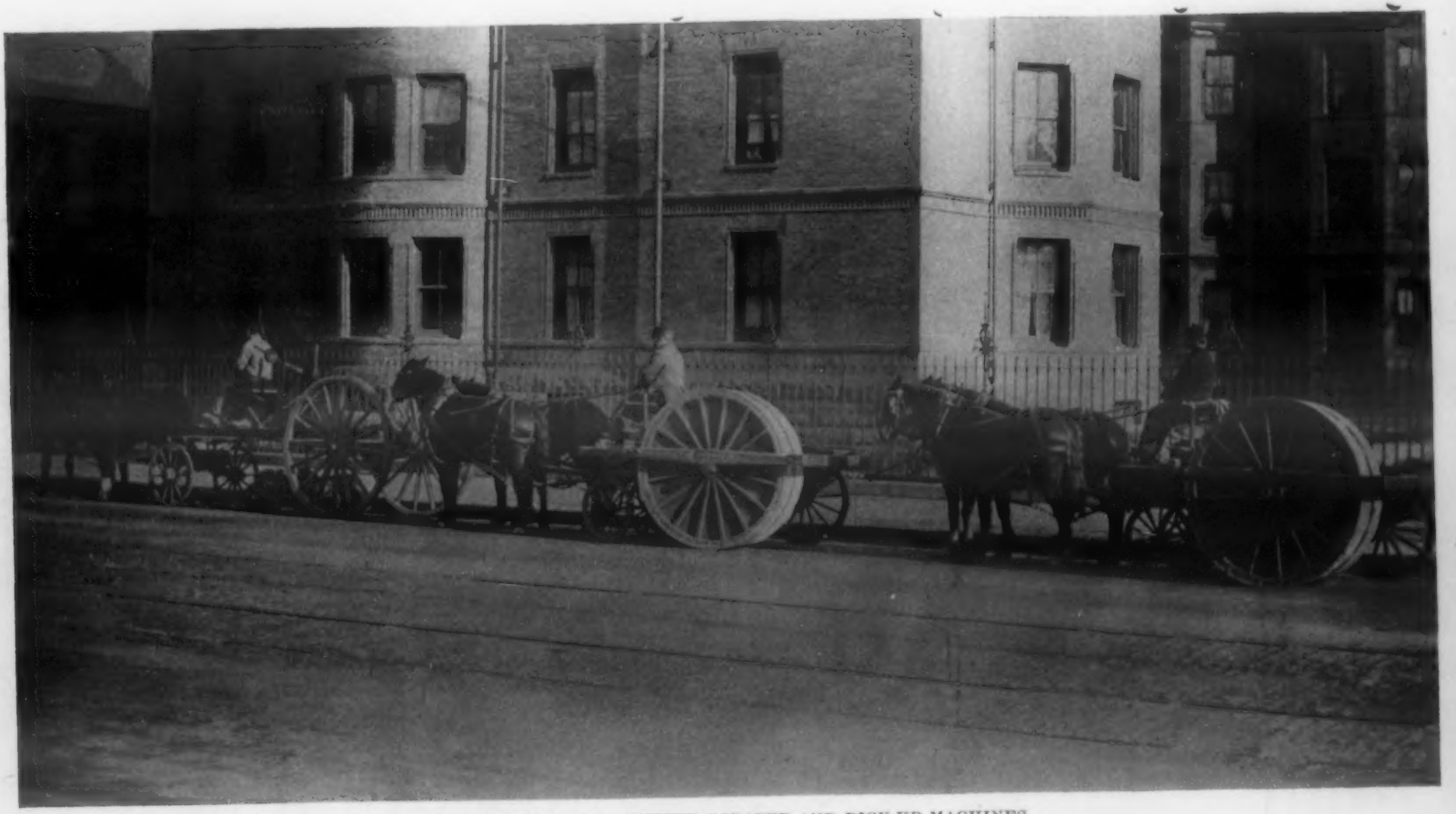
Some views of the work of brick street construction were given in our April number in illustration of Mr. Tarrant's article on "Modern Brick Street Construction." Another view is given herewith showing the operation of laying brick and rolling them with a light steam roller. A novel use of the heavy roller, provided for rolling subgrade, is shown in another illustration, the complete removal of a tree trunk and its roots being comparatively easy.

EFFICIENT MANAGEMENT AND MAINTENANCE OF WATER-WORKS OWNED BY MUNICIPALITIES OR PRIVATE CORPORATIONS.

By Benjamin L. Williams, Jr.

Efficiency in the management and maintenance of a water-works system, especially a small one, is one of the problems which confront a large number of municipalities and private corporations. Since almost every plant ever installed has been bonded or mortgaged for all it is worth to build it, both municipalities and corporations are somewhat handicapped by a rather healthy interest account. This is usually large enough to eat up all the profits for the first ten years at least, and as the growth of a water-works is necessarily somewhat slow, it takes a number of years to get rid of the interest octopus. Yet with few, if any exceptions, every water-works can be made a source of profit to its owners, and it only remains to apply a few simple, but most efficient rules to place the plant on a paying basis.

In order to operate a plant successfully it is necessary to employ a superintendent who is a good manager and has business and mechanical ability enough to be able to cope with the difficulties which may arise, of which, in a newly-built works, there are not a few. Too often a man is employed at five hundred dollars a year and is expected to do a thousand-dollar job. This is false economy and in a great many cases is one of the secrets of the failure of the plant to give the proper returns. If the governing bodies



CAMBRIDGE, MASS., GUTTER SCRAPER AND PICK-UP MACHINES.

would take this into consideration there would be no cause for the general inquiry, "Why don't our water-works pay?" The solution of the problem is directly under their thumbs, but they do not seem to realize that the employment of a man who is up-to-date and a hustler is the first step to success, but as a rule run along in a slipshod manner. While this is very much to be regretted, yet, nevertheless, in a great many cases, it is so.

However, we will assume that a man does get what he is actually worth, or at least a living salary, and he has the support of the governing bodies, but on account of the partial isolation of his town from the larger cities, he is somewhat in the dark as to just what he should do to get a better return for the investment, or just what methods are employed elsewhere to place a plant on a paying basis. With a plant supplied by gravity pressure the solution of the problem is a compartively simple one, and with the pumping pressure the main features would also apply. The first step would be the installation of a large meter or meters on the supply at a point on the outskirts of the town, the purpose of these being to detect leaks on the large mains, which in a new plant is a large item, and should, therefore, be cared for immediately. This is very important, and no delay should be made in repairing them. The next step would be to decide upon a meter rate for the consumers. This is a difficult matter with some places, but it is possible to do it, although the method may vary in different localities. Then install meters on every tap made. Thus far the expense of the meters and their installation will have been partially paid for by the detection of leaks on the large mains, and the prevention of waste by the consumers on the services, which is as great, if not the greater item of the two.

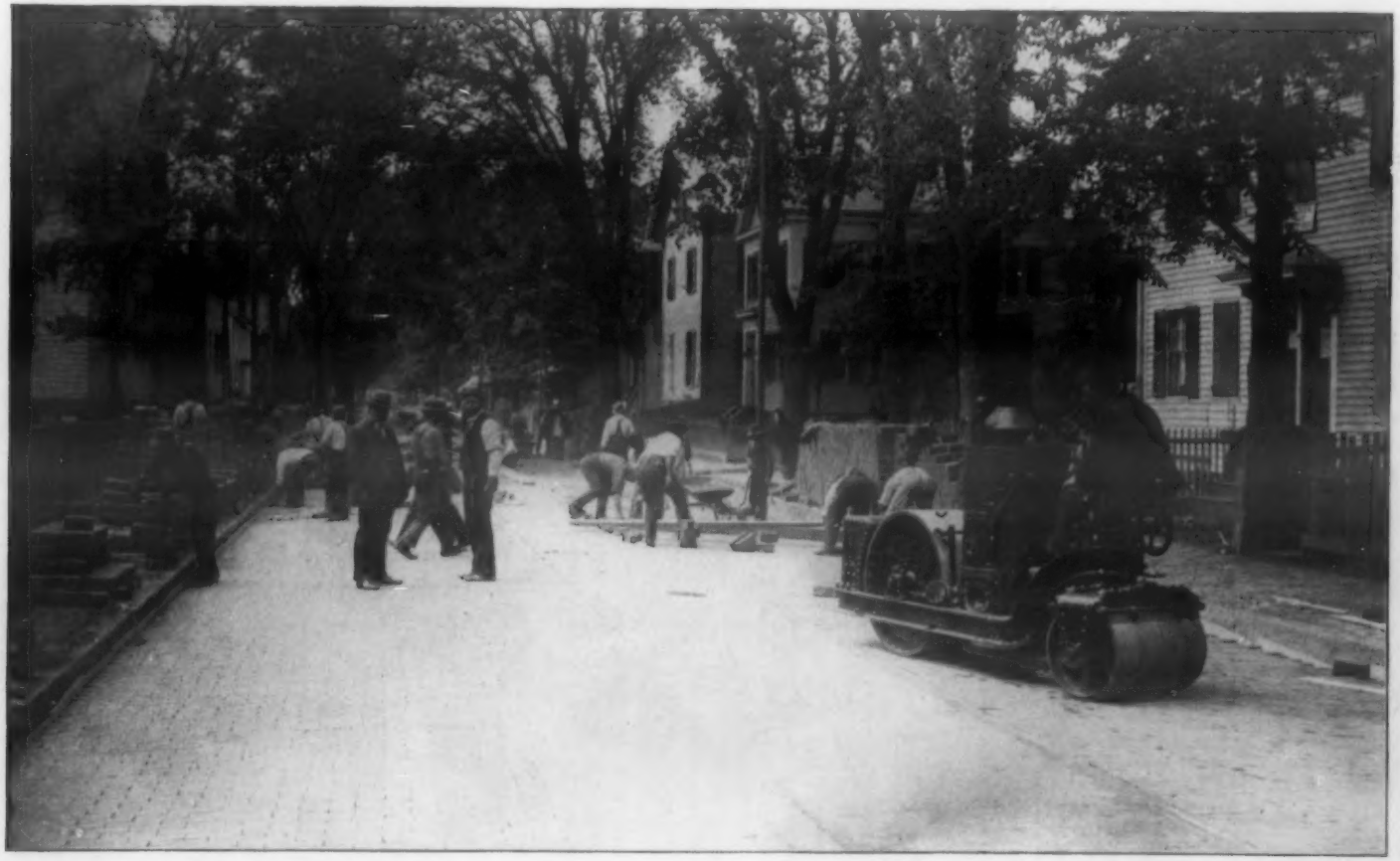
The systematic flushing of the mains through the summer would improve the supply and keep the plant in better shape. What I mean by flushing is to flush, not open a hydrant a quarter way and allow the water to run to waste for a week, but to open the hydrant *full* and let it run until the water is clean. This takes about ten or fifteen minutes ordinarily, and gives results without the waste of water. The elimination of dead ends would reduce the necessity of flushing so often, but as this can hardly be expected in a large number of localities, the observance of the above suggestion would be of value.

The comparison of the large and small meters will tell where the water is going, and, in order to make this a success, the large meter should be read at least three times a week, or more frequently if possible. It will be noticed that there is an average daily consumption, and should the meter show more than this, then it is time to go out and look for trouble, keeping in mind the most likely place where it would occur, and when found, to settle it at once.

All bills should be rendered quarterly, whether for fixtures, of which there should be very few, or meters. This would call for the inspection of the entire plant once in three months, which, coupled with the interest a man should take in his work, would be sufficient to detect any irregularities which may occur. The close collection of accounts is a most important matter and is too often the stumbling block in municipal ownership. It is as great a problem as that of keeping the supply down to a minimum; the methods to be employed are a pleasant but insistent manner and business tact, and this coupled with the support of the higher officers will soon get the consumers in the habit of paying promptly.

The establishment of the rules and regulations, is a matter to be considered very carefully. And when they are established, *enforce them*. This is of extremely great importance and on this alone a great part of the efficiency of operation depends. Unfortunately in municipal ownership, politics are allowed to take such an active part in the management of the plant, as to almost totally prevent it, whether the town is small or large. Mr. L. N. Case hit the nail on the head when he said "To be successful, municipal ownership must be real, not simulated; it must be public ownership complete—not private ownership by public officials." If this is not impossible, the responsibility of the successful operation of the plant devolves upon the superintendent. And if he is a man who takes pride in his work there is no doubt but a great many of the small plants, and some of the large ones, too, would receive very different returns from what they do now.

To sum up, the efficiency of a plant depends upon the closest attention to details, the installation of meters, both on the service and supply, the comparison of them at stated intervals, the rendering of accounts quarterly, the close collection of the same, the enforcement of the rules and regulations, the keeping in touch with all the details of the works, the systematic flushing of hydrants; in short, the conscientious discharge of his duties by the superintend-



ROLLING BRICK PAVEMENT WITH TWO AND ONE-HALF TON STEAM ROLLER, CAMBRIDGE, MASS.

ent, the support of the superintendent by the higher officials, and in cases of municipal ownership the total elimination of politics.

In municipal ownership the establishment of lower rates to the consumer necessarily follows, after it has been proven that a plant can be operated on a paying basis at a minimum cost and in private ownership a greater source of profit to its owners, which are the results sought for.

EDITORIAL COMMENT.

Freight Rates on Cement.

The extension of the territory in which cement can be manufactured is very rapid, as the increase in its use convinces capitalists that there is money in the manufacture of the material, and the experts are set to looking for suitable materials where business considerations indicate that it is desirable to locate mills. It was long thought that good American Portland cement could not be manufactured except in the Lehigh region, though there had been a few more or less successful attempts in other parts of the country with other materials. But further successful experimentation with marl and clay has led to a large increase in the works using these materials in Ohio, Indiana and Michigan. The presence of unusually pure limestone in the neighborhood of the same region has led to the use of limestone and clay, and this in turn has largely increased the possible field for the location of cement works. Thus nearly every state in the union, with reasonable density of population, which has these materials of proper quality, is now provided with one or more cement mills, turning out Portland cement of some quality, and the projected works will soon fill out the gaps in the list.

It is evident, therefore, that the freight rates on cement are of great and increasing importance as factors in the competition for trade and will often turn the scale for or against a certain brand. When brands are equal in quality and in cost of manufacture, the one whose freight rate is the least will make the sale. When a poorer brand comes into competition with a better, this question should not have so great weight, and a careful study of the two brands will show their relative economy, in case either is safe to use, and thus show which should be chosen. The collection of evidence concerning the quality of materials, the character of process of manufacture, the care taken and the treatment after manufacture, as well as the consideration of the results of tests, physical or chemical, are thus becoming more essential to economy in purchase of materials. The large number of new brands make this collection and consideration also necessary to distinguish the good cements from those which are made with less care from hastily selected materials by less competent operatives.

As will be seen from an examination of the descriptions of cement works in the Directory of American Cement Industries and Hand-book for Cement Users, nearly all of the new works are designed to follow the same general program of operations, the details being modified for the variations in materials and the particular machinery adopted, so that if due attention has been paid in the location of the works to economy in handling raw material, the cost of cement at all well managed mills should be very nearly the same, or at least should vary only with the nature of the raw materials, thus dividing the cements into two or three classes on the basis of cost of manufacture. Reasonable profit and freight charges added to this cost will give the cost of cement delivered. Under such uniformity of conditions, freight is an important factor.

A valuable feature of the Directory is a table, prepared largely by the Interstate Commerce Commission, giving freight rates from the important centers of cement manufacture in the states from New York to Wisconsin, to about forty centers of distribution scattered over the country. This table will be found valuable in other ways than to determine that the freight rate from Allentown, Pa., to Memphis, Tenn., is 32 cents a hundred pounds in carload lots, though this is the most obvious and perhaps the most valuable use.

The most striking feature is the clearness with which it shows the prohibitory nature of the freight rates upon the sale of cements from a distance if the cost of cement alone is to be considered, and the great advantage which home-made cements have in this regard.

This would show more clearly if the list of cement factories included those in the Dakotas, Colorado, Utah and California. A reputation for making good cements for all purposes will put local factories in such instances in command of the market to the exclusion of all American or foreign brands.

REMOVING TREES WITH STEAM ROLLER, CAMBRIDGE, MASS.

Another feature of interest is the showing of the comparatively slight difference in freight rates from the important districts where cement is manufactured to the distributing points. Even in such cases as the rates from the Lehigh district and from the Michigan district to Chicago, the difference is but 40 cents a barrel, approximately, while in almost all other cases it is materially less. Greater economy in manufacture may easily enable a distant competitor to undersell a nearer cement of equal quality. Reference may be made to the table for other points of interest. It will be ready for delivery a very few days after the receipt of this number of MUNICIPAL ENGINEERING.

Stream Pollution. A New Jersey jury has given a verdict for $3,000 in favor of an ice company against the city of Paterson apparently on the ground that this was the value of ice, the sale of which was destroyed by the sentiment against its use on account of the pollution of the stream, rather than because any actual damage to the ice was proved. Whether the higher court will sustain this verdict is a question which will probably be decided later.

The supreme court of Wisconsin has affirmed the decision of a lower court enjoining the city of Waukesha from discharging unpurified sewage into a stream and granting a jury trial to determine damages for injury already sustained. The statement by Judge Dodge of the grounds on which the decision is based is the clearest statement of them which has yet been made. It is as follows:

"We can not but recognize that as the density of our population increases, as our citizens engage in new and greater industries, and as the municipal aggregations of population multiply and expand, the original purity of streams and water basins can not be wholly preserved. They are the natural and unavoidable courses and receptacles of drainage, through and into which must flow the refuse of human habitation and industry. How far these changing conditions must bring about a yielding of the private rights of continued purity of those lakes and streams to the necessity of use thereof for the public and general health and convenience, and upon what terms such yielding shall come, are primarily questions of policy for the legislature, within the limits of its power over private rights defined by the constitution. When, if ever, the legislature shall enact that streams generally or any streams shall be used as sewers without liability to the owners of the soil through which they run, the question of constitutional protection to private rights may be forced upon the courts for decision. Until such enactment is made, however, in clear and unambiguous terms, we shall be slow to hold by inference or implication that it has been made at all. The right of the riparian owner to the natural flow of water substantially unimpaired in volume and purity is one of great value and which the law nowhere has more persistently recognized and jealously protected than in Wisconsin. Not alone the strictly private right, but important public interests would be seriously jeopardized by promiscuous pollution of our streams and lakes.

"Amid this conflict of important rights, we can not believe that the legislature concealed, in words merely authorizing municipalities to raise and expend money for the construction of sewers, a declaration of policy that each municipality might in its discretion, without liability to individuals, take practical possession of the nearest stream as a vehicle for the transportation of its sewage in crude and deleterious condition. The authority granted to municipalities is to construct sewers, but subject to the general legal restrictions resting upon such corporations forbidding invasion of private rights by the creation of nuisance or otherwise. This view of the legislative purpose is enforced by the consideration that although liquid sewage must flow off along the general drainage courses of the vicinity, it is by no means physically necessary that it should carry with it the solids in an offensive or unhygienic condition."

Partial consideration of the question, concluding the argument before reaching all the points stated above, has caused the peculiar decisions in an Indiana case and in two or more New Jersey cases. That courts and juries in New Jersey do not agree is shown by comparing cases reported in these columns in this and preceding months. Such arguments as the one by Judge Dodge will go far toward establishing the basis for all decisions on the subject of stream pollution, and will reduce the variation in decisions, which is now the most striking feature in litigation upon the matter.

Road Repair. The Illinois Agricultural Experiment Station, at Urbana, Illinois, has issued a bulletin, written by Professor I. O. Baker, of the University of Illinois, on the "Construction and Care of Earth Roads in Illinois," which puts into classified and complete form the practice

of the best road repairers of the state, and is so clearly stated that the farmers, for whom it is intended, can, if they wish, follow the instructions given with great advantage to the earth roads of the state. The bulletin has gathered together the ready methods developed in the field, and if it is used as a guide the roads will be greatly benefited. Forty years of similar instruction has, however, had little effect upon the condition of the roads in comparison with the amount of money expended upon them. There are two interacting causes for this; one, the slight interest actually taken in improvement of roads by the average farmer, and the other, the slipshod system of road supervision and repair. The removal of either one of these drawbacks will practically remove the other. Instruction by newspaper, bulletin, lecture, or discussion has little or no effect upon either, if judged by actual results, and Professor Baker's bulletin is not likely to have any appreciable effect, notwithstanding it is as clear and complete a code of procedure in road repair as has been prepared.

Practical application in other countries and theoretical conclusions in this indicate that no material advance can be expected until the management of road repair is put into the hands of intelligent supervisors who are given sufficient power and are held responsible for the condition of the roads in their charge. College graduates are not necessary for this work. Almost every township has more than one man who would make an ideal road supervisor, if he were put under some central expert direction or source of advice and the methods of procedure were so changed that he could be actually in charge of the work, and held responsible for its proper performance. Such intelligent direction of the work will keep the roads in much better repair for the same time and money expended; such improvement in roads will elevate public opinion on the subject, and substantial progress toward good roads may be expected. The ordinary earth road is not a good road, notwithstanding the fact that it is at times the best road imaginable. No road is a good road which fails at any season of the year; certainly none which is actually impassable, even for a day, on account of its condition as a whole. In can be made to approximate much more closely to a good road if Professor Baker's suggestions are followed, but they will not be followed unless more central and expert authority and more responsible and thorough supervision are provided.

The Indiana legislature has just established a form of road supervision under the county council as a central authority and with district supervisors appointed by them. Each supervisor has charge of not less than ten nor more than fifteen miles of road. The system is applied to gravel roads but it can be applied to all county roads as well, so that its success or failure under the conditions of the statute will be of value in further consideration of the subject.

Water Meters. The paper by Mr. A. L. Holmes on the "Cost of Installing a Water Meter System," in another column, gives some practical discussion of an important question in water-works management and information of much value regarding the cost of installing a meter system which should aid water-works officials materially in developing favorable public opinion. Mr. Holmes' argument in favor of charging the cost of meters and setting to the water-works is a good one. It might be made more definite in one respect, and the charge made to capital account, for all the evidence shows that the application of meters diminishes the demand for water, on account of diminishing waste and unauthorized uses, and thus reduces the capital investment required. The comparatively small investment in meters should be counted as a partial offset to this reduction in capital account. The reduction of course takes the form usually of a postponement of the time when an increase in capital account must be made.

Mr. Holmes' examples of the saving by the introduction of meters are from the smaller cities. Hartford City, Indiana, increased the number of taps about 25 per cent. from 1898 to 1900, none being metered the former year and all being metered the latter year. At the same time the consumption of water was decreased about 12.5 per cent. Notwithstanding this reduction in the amount of water supplied, the revenue increased about 80 per cent. With the saving in pumping expenses, this would almost pay the $5,500 cost of installing meters in one year. The increase in the revenue per tap from $5.74 in 1898 to $8.51 in 1900 would indicate that the cost of water to consumers is materially greater under the meter system than before the meters were introduced. This is not the usual experience, nor is it one which will make the introduction of meters popular. The large increase in revenue, coupled with the material decrease in consumption, indicate that the meter rates are too high for the local cir-

cumstances, that a judicious reduction should be made in the interest of the consumers, and that the revenues of the works are sufficient to warrant this reduction. This is true, notwithstanding the revenue per tap is well below the averages given below.

Mr. George I. Bailey, superintendent of the Albany water-works, has compiled a table from information gathered by him for its bearing upon this subject of the use of water meters, which covers most of the cities of 25,000 population or more in the country. The columns of interest in this connection are those giving the consumption per capita and the percentage of taps metered. To show the effect of meters upon consumption Mr. Bailey has made averages which show that when less than 10 per cent. of the taps are metered the daily consumption averages 153 gallons, ranging from 32 to 300, or more justly, from 62 to 280, the outside figures being abnormal; when 10 to 25 per cent., 110 gallons, ranging from 56 to 225; when 25 to 50 per cent., 104 gallons, ranging from 46 to 273; when more than 50 per cent, 62 gallons, ranging from 29 to 120. An examination of the table in detail indicates that the averages are fair indications of the relative standing of the various classes, and the number of cities in each class is large enough to give weight to the result. The average consumption of all the cities in the table, 136 in number, is 137 gallons per capita. It is thus seen that with practically no meters in use the consumption is 12 per cent. more than the average, and in cities with more than 50 per cent. of the taps metered, the consumption is less than half the average. The seventy cities in the class with less than 10 per cent. of taps metered overshadow the others in the average of all, which shows still more clearly the beneficial effect of meters.

While there are many more independent variables in the determination of the receipts per consumer in the various cities, a consideration of this column may have some interest. In the fifty cities reporting this item who have less than 10 per cent. of taps metered the average revenue per consumer is $2.50, or $15 per tap on Mr. Bailey's assumption of six consumers per tap. The range is from $1.14 to $4.92. In the twelve cities having from 10 to 25 per cent. of taps metered the average revenue per tap is $2.29 per consumer, or $13.74 per tap, the range being from $1.19 to $3.34. In the sixteen cities having from 25 to 50 per cent. of taps metered the average revenue is $2.85 per consumer, the range being from $1.11 to $8.87. There are two extra large results in this list. One, $8.87 is for Duluth, whose rates have since been reduced 20 per cent., and the other $5.06 is for Springfield, Mass. If these are omitted, the average revenue for the fourteen remaining cities is $2.26 per consumer, or $13.56 per tap, and the range is from $1.11 to $3.33.

In the twenty cities having more than half their taps metered the average revenue per consumer is $2.43, or $14.58 per tap, the range being from $1.32 to $4.25. There is here a slight though definite indication of a decrease in cost of water to the consumer paying the meter rate. In some instances it is undoubtedly true that the meter rates are fixed too high when meters are first introduced, and they can be materially reduced later. If so, the reduction in cost of water to consumers will show more clearly in later reports.

Uniform Municipal Statistics.

The National Municipal League holds its next meeting at Rochester, N. Y., on May 8, 9 and 10, and will devote much time to the discussion of uniformity in municipal accounting. The program includes a report of the league's committee on this subject, including a discussion of tentative schedules applicable to financial reports of cities; papers on municipal statistics and methods of securing uniformity in England, Germany, France and Italy; present conditions in the United States, and what steps can be taken to better conditions. The afternoon of the 10th is specially devoted to this subject.

A request has been sent to the members of committees of other societies upon the same and related subjects to meet with the league, and to join in a conference of committees on Saturday, May 11, at which it is proposed to discuss the proposed schedules, the extent to which uniformity can be and should be attempted, the practicability and methods of securing favorable action by the city, state and federal authorities.

There is at present urgent need and a strong demand for uniformity, and concerted action will undoubtedly be productive of beneficial results. Several cities have already signified their willingness to adopt the uniform scheme, and an opportunity is now open to accomplish much.

It has now been nearly five years since the American Society of Municipal Improvements began the agitation of its particular branch of the general question, and so far as correspondence with other societies

working in the general field is concerned, there is but little more interest in the subject than at that time, the Committee of the National Municipal League excepted. A good attendance of the members of such committees as have been appointed is much to be desired and would undoubtedly result in material increase in interest. Unless attending the League meeting, however, and present on this account, a reasonable representation of the societies which should be interested is doubtful.

One reason for the lack of interest in many of the societies is the fact that their membership is nearly all outside the work which it is desired to regulate, and aside from the lack of personal interest there is the innate dislike to seem to interfere with the business of others in which one is not personally interested. The movement is in the interests of good government and honest administration of it, however, and as such should be of personal interest to every voter and tax-payer. In the most thoroughly technical branches of city work will be found the most interest in some particular branch of the general subject, but those are the departments in which there is the least need of opening up methods and accounts to the light.

THE QUESTION DEPARTMENT.

CONCRETE BLOCK FOR STOP-BOX.

In this city we have sometimes run considerable stretches of small pipe to reach a customer removed some distance from our cast iron mains. For this purpose we have used galvanized pipe, as it would not pay to use anything more expensive. Most of our streets are not paved and we find that a stiff road-box placed over a valve in the galvanized pipe line is unsatisfactory in that it imparts a shock to the small pipe when the box is struck by a wagon. Consequently we wish to use a telescopic box. In the course of time, however, these boxes gradually work down below the level of the soft streets, and are difficult to locate. We therefore desire some device to hold the top of the telescopic box level with the street surface. The outside diameter of the box may be as much as two inches. We are wondering if we can make a cement or concrete block, round or square, with hole in the center to admit the body of the box, after which the top will be screwed on. This concrete block will have to be strong enough to stand weather and the occasional impact of a wagon wheel. It would not be exposed to steady travel—in fact very little—but might occasionally be struck by a wagon wheel. We would expect to imbed it firmly in the soil, even with the surface. What we wish to know is what thickness and size in other dimensions to make this block in order to stand the conditions noted, and the proportions of sand, cement and gravel.

Henry Lautz,
Sec'y Water-Works Co., Pekin, Ill.

The construction proposed should be satisfactory, if a block about two feet square is set as described. The foundation should be about four feet long in the direction of traffic and somewhat wider than the block. The block should be sloped down in each direction from the surface to the outside of the foundation, so that at the outer edge it is six inches or more below the surface, so that wheels approaching in the mud will strike this sloping surface rather than the edge of the block. The surface of the center of the block should receive a slight crown in the direction of traffic, not more than an inch or so. The block should be laid according to the specifications for concrete street crossings in the "Directory of American Cement Iudustries and Hand Book for Cement Users," making a foundation of several inches of broken stone or gravel, covered with four to six inches of cement concrete made in proportions of about one part first-class Portland cement, three parts sand and six parts broken stone, finished off with a top one or two inches thick of one part same cement and one and one-half parts hard, coarse sand. The block should be laid all at one time, that there may be thorough bond between the courses. See this department for April for answer to question on construction of street crossings.

CEMENT SIDEWALKS.

I would like reference to articles on the construction of cement or artificial stone sidewalks.

L. N. Howe, St. Charles, Minn.

Where can I procure the standard method of laying artificial stone pavements, and information about the tools required in connection with the same?

B. H. Nicholas, Philadelphia, Pa.

Can you inform me how to mix and lay cement walks and curb, and what is used to give the cement different colors; also, what a set of tools for doing this kind of work will cost?

L. D. Clark, Lakeport, N. H.

Can you refer me to specifications for cement concrete walks and crossings?

R. P. Drake, Village Clerk, Humphrey, Neb.

See pages 16, 23, 24, 86, 427, of Vol. XIX of MUNICIPAL ENGINEERING, July–December, 1900. "The Directory of American Cement Industries and Hand-Book for Cement Users," which will be issued from the press in a few days, will give full details of the methods of mixing and laying cement walks and curb, as well as of securing

cement which will give good results. It is the most complete book on the practical use of cement yet prepared. The coloring matters used are fully described with proportions. See, also, the short article on colors for concrete in this number. Tools for cement walk work are furnished by several manufacturers, for which reference may be made to our advertising columns. They cost from one to two dollars a set.

ARCHED SIDEWALK CONSTRUCTION.

Will the "Directory of American Cement Industries" give instruction on the construction of floors, roofs, bridges, etc., using cement concrete and steel or iron, also cement walks and steps? Which is preferable to support a vaulted walk, I-beams with corrugated arched sheet steel, arched wire netting with rods in it, or expanded metal at the bottom of the cement supported during construction by wood?

Geo. W. Clark,
Wausau, Wis.

The Directory gives full descriptions and specifications for the construction of Monier, Melan and Thacher arches, which are directly applicable to the other forms of steel used for similar work. Cement walks are also fully described. The construction of cement steps differs only in the necessity of making forms into which to tamp the material to the desired shape. For the ordinary sidewalk, I-beams placed say three feet apart with arches reinforced by any of the methods mentioned will be satisfactory. In general, that construction is the most durable in which the steel is completely imbedded in the concrete. If the walk or drive is subject to heavy weights or to shocks from heavy weights falling upon it, there must be special care to make the beams and arches strong enough to stand the extra strain. The usual thickness of walk, with the arched form given its lower surface, is sufficient for the ordinary sidewalk, seldom subject to anything but foot traffic.

BOOKS ON PARKS AND CEMETERIES.

Will you please name one or two books, or publications, from which I may get information pertaining to cemeteries and parks, especially the former?

M. A. Kirby, Florence, Ala.

Loudon's "Encyclopedia of Gardening" ($7.50), Parsons' "Landscape Gardening" ($3.50), are two books which will furnish valuable information. "Park and Cemetery" was published monthly at Chicago for some time, and devoted to the subjects denoted by its title. A copy has not been seen at this office for some time and it may be discontinued. MUNICIPAL ENGINEERING contains many hints on these subjects, more particularly on parks, and the back volumes have many illustrations of park plans and their results, which should furnish many valuable pointers.

BOOKS ON HYDRAULICS.

What book that treats on hydraulics shall I get to help me to solve problems on flow of sewage and the like?

Forest Talbott, Rodman,
Owensboro, Ky.

Merriman's "Hydraulics" ($4) is probably the most satisfactory book for your study of the principles of hydraulics. With sufficient knowledge to know how the tables are made and how and when to use them, such tables as those in Folwell's "Sewerage" will answer quickly most of the questions on rate and quantity of flow of sewage. Colby's Sewer Computer is a very satisfactory application of the slide rule to the same class of problems.

SEWER PIPE AND CONNECTIONS.

Which is the better material for sewer pipe, fire clay or shale, and which is the more lasting? Is it not a great injury to sewer pipe to break holes in it for connections?

M. J. Dill, Kane, Pa.

It seems to be the general opinion of those who have most experience in the use of sewer tile that the tile made of shale are more durable than those made of fire-clay, but the method of manufacture has something to do with the case, and a good fire-clay tile is better than a poor shale tile. Both should be salt glazed. The quality of the tile can not always be told from the color. Tile should never be cut for connections. If a connection is needed where the "Y" was not inserted when the sewer was first constructed, a joint of the pipe should be removed and a new joint with a "Y" should be inserted. This is the only way in which the sewer can be kept in its proper condition. No matter how well the work of cutting the hole for a connection is done, there is a chance for damage to the pipe and the sewer, which will certainly give trouble at some time, even if the work is well done at the beginning.

BOOKS ON ELECTRIC RAILROADS AND EQUIPMENT.

What are reliable works on construction and equipment of electric railroads?

Hiram Bruner,
LaPorte, Ind.

Our book lists have the following titles: Dawson's "Electric Railways and Tramways" ($12.50), on design, construction, equipment and working; "Bell's Power Distribution for Electric Railways" ($2.50), on laying out electric railway circuits; Crosby and Bell's "Electric Railway in Theory and Practice" ($2.50), a systematic

treatise; Hanchett's "Electric Railway Motors" ($2); Houston and Kenelly's "Electric Street Railways" ($1), for beginners; Merrill's "Reference Book of Tables and Formulæ for Electric Street Railway Engineers" ($1); Perry's "Electric Railway Motors" ($1), elementary, intended for motormen; Prindle's "Electric Railway of Today," paper (50 cents); Trevert's "Electric Railway Engineering" ($2); see also page 22 of January number. MUNICIPAL ENGINEERING can supply any books desired.

BRICK PAVEMENT ON BRIDGE.

What is the usual practice in laying brick pavement on bridge or viaduct? Would plank base with 2-inch sand cushion be satisfactory?

John W. Hahn,
Boston, Mass.

A serious objection to the use of brick on a steel bridge or viaduct is the excessive weight, due to the thickness of the brick blocks and to the sand cushion. An arch bridge of sufficient strength to carry the brick pavement would supply foundation sufficient. A little computation would show the heavy weight of a sand cushion even one-half inch in thickness and this would be but a small part of the weight of the brick. Asphalt is used on steel bridges because it can be laid in a thin sheet, and wooden blocks because they are comparatively light. The ordinary sand cushion is omitted or reduced to the lightest possible. The bridge can be made strong enough to carry the brick pavement, but what is saved in cost of pavement is more than made up by increased cost of steel.

STANDARD BRICK SPECIFICATIONS.

Can you refer me to the "Brick Manufacturers' Standard Specifications for Paving Brick?" We wish to refer to them in making specifications for about four miles of brick streets.

L. B. Merriam, De Kalb, Ill.

The National Brick Makers' Association proposed standard specifications for brick tests in 1897, which were modified somewhat in 1899. These are discussed in articles in MUNICIPAL ENGINEERING of April, 1900. The Committee of the Association still has the question under advisement and expects to report this year. It should be noted that these are specifications for testing paving brick. The association has been very careful not to propose any specification by which brick shall be accepted or rejected on the results of these tests. This is left to the local engineers to determine in accordance with local requirements. Standard methods of constructing brick pavements were proposed at the last meeting of the association. These matters are given and discussed on pages 211, 219 and 232 of our last number (April, 1901).

Professor Talbot's proposed standard method of conducting the rattler test of paving brick is described on page 97 of the number for February, 1901. This method is under favorable consideration by the committee of the N. B. M. A. Until that committee reports it is well to say that the N. B. M. A. has no standard specification for testing paving brick. It never had, and probably never will have, a standard specification for paving brick.

PLATS OF RAILROAD PROPERTY.

Should railroads be required to file plats of their property in the city with the city engineer, showing distances from block corners on all streets that are crossed? What is the practice in cities?

J. F. Parr,
East St. Louis, Ill.

Many cities and towns require the filing of such plats. Those who do not must be satisfied with the descriptions and plats filed with the County Recorder of Deeds and Plats. It is hardly possible to demand greater accuracy of these plats than the city obtains in its own surveys. Theoretically the city block corners should be definitely marked and all descriptions of property should be referred to them, the same detail being required of railroads as of other persons platting city territory. Practically, the block corners are seldom marked except by buildings and curb lines, liable to removal at any time, so that even if required by ordinance to file the plats suggested, the railroad engineers can successfully delay filing of plats on the plea of indefinite city lines, which it is not their business to determine. Practice should conform as closely to theory as possible and agitation of such questions as this may be beneficial in bringing about greater accuracy in city records and markings.

INDIANA SPECIAL ASSESSMENT LAWS.

In the past few months you have given notice in your MUNICIPAL ENGINEERING of considerable paving which was to be contracted for in the State of Indiana. As it is the general belief of Chicago contractors, also of the attorneys who pass upon the validity of special assessments that the Barrett law is unconstitutional and that there might be great difficulty in receiving payment on bonds for any work which might be done under the Barrett law, I write to inquire if you are aware of any change which has been made or which will be made in the near future in the special assessment laws of Indiana.

James A. Sackley,
Chicago, Ill.

Most of the decisions bearing upon the constitutionality of the Barrett law have affirmed it. The principles of the law are

discussed in a decision by the Indiana Supreme Court in the case of Thomas B. Adams against the city of Shelbyville, reported on page 399 of MUNICIPAL ENGINEERING for June, 1900, and the court holds that each provision of the law is fully sanctioned by the constitution of the state. The constitutionality of the law was again affirmed directly in the case of Annie E. Taylor against the city of Crawfordsville, reported on page 424 of MUNICIPAL ENGINEERING for December, 1900. Similar opinion is expressed regarding the general law in the decision upon the case of William Holt against the city of Indianapolis, in which the application of the Barrett-law system in the Indianapolis charter is upheld.

Decisions in state courts against the constitutionality of the law have all been in lower courts and were prior to these expressions by the supreme court.

In the United States Court the decision was adverse in the case of James Charles against the city of Marion, reported in page 55, January, 1900; page 259, April, 1900; and page 45, July, 1900, in its various stages.

These decisions indicate that the Barrett law is applicable to residents of Indiana, but non-residents owning property in the state have an opportunity to escape assessments if the Federal court adheres to its decision in the case quoted.

On page 238 of the April number will be found abstracts of two laws passed by the last legislature, one on street improvements in cities organized under the general law, taking the place of the Barrett law in such cities, and the other on notice to property owners before liens for street improvements can be enforced against property, which attempt to remove opportunities for doubt regarding the constitutionality of the methods of procedure.

CONCRETE STREET CROSSINGS AND STREET RAILWAY.

We have a contract for improving a street in which the specifications provide for laying street crossings of Portland cement concrete. A double-track electric railway has been laid. The contractor now objects to laying concrete crossings, claiming that the tremor caused by passage of the cars will crack the concrete before it can set.

The excavation was eighteen inches below top of rail; foundation, four inches of broken stone rolled with fifteen-ton roller and covered with four inches of gravel for bedding and tamping ties. Can the cement concrete crossings in and between the tracks, and on ties outside of tracks, be laid without damage from the tremor caused by the passage of electric cars once every half hour?

L. W. Mathewson,
Cincinnati, O.

With an 8-inch foundation under the rails as described the tremor from the passage of the street cars should be slight. It would undoubtedly be advisable to run the cars over the crossings very slowly for a few days until the cement has thoroughly set, as a precaution easy to take. Repairs to the portion of the walk between rails and track will be required more frequently than elsewhere, on account of the isolated blocks and the vibration of the road-bed, without reference to the time of setting which the cement requires, which will tend to separate the concrete blocks from the foundation, especially where ties make the depth slight. This will render the blocks more liable to being moved or broken by wagons passing over them.

MUNICIPAL MATTERS IN COURT.

Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.

Power to Narrow Streets.—A Texas statute conferring on the city council exclusive control over public streets and giving the power to alter, widen and extend the same, is held to give authority to curtail the width of a street. Scott et al. v. City of Marlin et al., 60 S. W. Rep. 969.

Obstruction of Streets.—A city has no right to erect and maintain a water tank or other permanent structure on a street which does not aid public travel, and which injuriously affects the beneficial enjoyment of the premises of an abutter, or his means of ingress or egress. Davis v. City of Appleton, 85 N. W. Rep. (Wis.) 515.

Specifications for Curb and Gutter.—A city ordinance authorizing the laying of a combined curb and gutter, with a center foundation six inches in depth, the curb to be six inches in thickness throughout, and the gutter-flags to be eighteen inches in width, the top of the curb to be at the established grade of the street, was insufficient to authorize a judgment confirming a special assessment, since it does not specify the height of the combined curb and gutter. Willis v. City of Chicago, 59 N. E. Rep. (Ill.) 543.

Permission to Lot-Owners to Improve Street.—Under the charter of the city of

Louisville, providing that "the general council may, in its discretion, upon a petition of a majority of the property owners on the part of a public way proposed to be improved, grant them permission to improve said public way, under the supervision of the engineer," a petition signed by an agent for property owners, which was granted by the council was sufficient to protect the property owners in the construction made thereunder, so as to exempt them from further taxation for that purpose. Though the charter required an ordinance for the construction of the street, yet, as the council by resolution, accepted the proposition of the lot owners, and permitted them to incur the expense of the work under the belief that they would be free from further taxation for the purpose, the city can not now charge the property owners with any part of the cost of reconstructing the street, upon the idea that the construction is an original one. Gleason v. Barnett et al., 61 S. W. Rep. (Ky.) 20.

Itemized Statement of Costs of Improvement.—A statute required a bill of costs of public improvement, showing in separate items the cost of grading, materials, laying down, and supervision, to be filed in the office of the clerk, and certified to by the officer or board designated to take charge of the improvement, together with a list of lands touching on the line of the improvement, names of the owners, etc. *Held*, that a notice to an abutter, filed with the clerk, signed by three persons designating themselves "Committee of Streets and Alleys," notifying him that his land, described as a forty-acre tract, one part of which was contiguous to an improvement, was taxed, etc., and that the total amount was a certain sum as per items annexed thereto, and attached to which was a column of figures footing up the sum stated to be due, but not showing what the items were, and not certified to, was not a compliance with the statute. Holland v. People, ex rel. Miller, County Collector, 59 N. E. Rep. (Ill.) 753.

Overhead Wires—Removal.—A Baltimore city ordinance authorizing telephone companies to lay wires in underground conduits, and to make necessary house connections, in such manner as may be best adapted to location, by means of wires from the cables laid, provides that the companies shall construct at least three miles of conduits within two years from the passage of the ordinance, and after said two years, and as rapidly as said conduits may be constructed and cables laid therein, all poles on any street along which such conduit is constructed and cable laid, shall be removed, and shall not be replaced, except in so far as such poles are necessary for the purpose of making distribution of wires forming part of any cable. *Held*, that the companies are not required to construct underground conduits in every street along which they desire to furnish telephone service, but they must remove all poles where a conduit is constructed and cable laid, except such poles as are necessary for distribution. Mayor, etc., of City of Baltimore, et al. v. Chesapeake & P. Tel. Co. et al., 48 At. Rep. (Md.) 465.

Municipalities and Trades Unions.—The records of the city council of Paterson, N. J., show the following entry: "Resolution by Alderman T. C. Wright, that this board place itself on record as desiring to favor anything calculated to benefit the working people of this city, and desires to express its sympathy for those who are endeavoring to better their condition: Resolved, that in furtherance of this idea we think that it should be the sense of the city government in every way possible to patronize such establishments as recognize trade unions and pay union wages to their employes. Resolved, that in pursuance of such principle, that the printing and stationery committee of this board and the officers of this city be, and they are hereby directed to confine all orders for printing and advertising, so far as it can be legally done, to such offices and newspapers that recognize the typographical union, and that the finance committee and city comptroller audit no bills for printing done in other than union printing offices." The supreme court of New Jersey has just rendered an opinion declaring the resolution void as tending to monopoly, and the imposition of additional burdens upon taxpayers. State (Paterson Chronicle Co., Prosecutor) v. Mayor, etc., of City of Paterson, 48 At. Rep. (N. J.) 589.

New York Labor Law.—The labor law (Laws 1897, c. 415, as amended by Laws 1899, cc. 192, 567) provides that laborers on public work shall be paid the prevailing rate of wages; that contracts for such work shall stipulate that they shall be void unless complying with the act; and that the contractor shall not be entitled to receive any sum, and no public officer shall pay the same for work done on a contract which in form or manner of performance violates the statutory requisites of such contracts. Section 3 provides that public officers violating the act shall be guilty of malfeasance, and that any citizen may maintain proceedings

to suspend him, or to avoid or cancel contracts violating the act, or to restrain payment on such contracts. *Held*, that the act is unconstitutional, since it takes away the liberty of freely contracting, both from municipalities and those contracting therewith. The act contravenes the provision of the constitution that no person shall be deprived of his property without due process of law. The legislature of a state has no right to interfere, and control by compulsory legislation the action of municipal corporations with respect to property, and contract rights of purely local concern. People, ex rel. Rodgers, v. Coler, City Comptroller, 59 N. E. Rep. (N. Y.) 716.

Powers of Street Superintendent.—Finlayson, St. Laws, p. 9, § 3, requires the city council, before contracting for sewer improvements, to pass and publish a resolution of intention "describing the work" proposed, and provides that the city engineer shall make plans and specifications and estimates of the cost thereof, which, by Id., p. 42, § 5, become part of the contract to be awarded when approved by the council. Id., p. 61, § 6, provides that the work must be done under the direction and to the satisfaction of the superintendent of streets. The ordinance of intention for the work required it to be done in accordance with plans and specifications on file in the city clerk's office, one of which provided that "when the ground does not afford a sufficiently solid foundation, the contractor shall excavate the trench to such increased depth as the street superintendent may decide to be necessary, and shall then bring it up to the required level and form with such material and in such manner as the street superintendent may direct." *Held*, that an assessment levied for work done under a contract based on such plans and specifications was not invalid on the ground that such specifications delegated to the street superintendent powers of the council. Haughawout v. Hubbard et al., 63 Pac. Rep. (Cal.) 1078.

THE COST OF INSTALLING A WATER METER SYSTEM.*

By A. L. Holmes, Grand Rapids, Mich.

In considering the question of the sale of water by the company or municipality to its consumers for domestic as well as for power purposes and mechanical uses, the question has been pretty well settled that we must know the amount taken by each consumer if we are to ask each to pay a fair price for the amount delivered.

We know to a reasonable certainty the amount of water furnished for all purposes by the pumping plants of the city and the total cost of operating them, and we get in this manner the cost of delivering a thousand gallons or a thousand cubic feet, as we may choose to reckon it; and it is the most reasonable way to sell this water in a manner that will return to the producer a just price for the product, and at the same time do no injustice to the consumer.

Only one means has been formulated to accomplish this result, although for hundreds of years various expedients have been resorted to to avoid this just way of doing business.

There has been enough evidence furnished and enough written and reported by the best and most experienced men in this line to convince all of the equity of the meter system.

What water meters have done for many of the departments, they will do for any of the others. They will reduce waste, increase pressure, increase revenues, settle disputes and satisfy the buyer and seller that this is the only equitable way to handle the water business.

Superintendent of Water Works J. B. Hein of Madison, Wis., has said:

"By the use of meters our saving in waste is 43 per cent., and our saving in fuel is 64 per cent."

The city of Ottawa, Ill., in the year 1897 decided to sell water only through a meter, and in consequence purchased 631 meters and placed them in service at once.

These meters cost them	$8,053 90
Placing them cost	1,204 26
A total cost of	$9,258 16
Or an average of each meter	14 76

Perhaps it will not be out of place to give the results of this business transaction as stated by the superintendent of water works. He says:

"As the main object in placing meters on all services was to preserve the artesian water supply and to prevent useless and careless waste, the operation shows that meters have saved of the water 39 per cent., and have decreased the pumping expense 63 per cent.

"This insures an ample supply of artesian water for years to come, and also gives

*A paper read before the meeting of the Michigan Engineers' Society, 1901.

consumers privileges in the use of water which could never be given under a flat or schedule rate."

In considering the cost of installing a meter system we are faced with the problem of who shall pay for the meter. The consumers of water from a public system must pay for the operation of the plant, for keeping it in repair, and for the interest on the outstanding bonds. If one-half of the product is wasted, this must be paid for by the customers and increases the cost of the product used. The more coal burned, the more must be charged to the maintenance account, and the more bills must the water consumer pay.

In practice, water plants must be operated and sustained by the money received from the water takers, and the meters are a part of a plant, the scales as it were, the expense attending them must be borne by those who use the water.

I find that generally people are better satisfied where the water department purchases, installs and keeps the meters in repair, and is recompensed for the outlay from the water rates, than where the consumers are required to advance the price of the meter and its setting in full.

If we could start a new plant and meter all the services as fast as put in our troubles would be less acute; but as the works are nearly all built, we must take things as we find them and do the best that we can to remedy the evils that for generations have been accumulating.

The selection of the kind and make of the meter should receive a good deal of consideration from the superintendent and should be controlled by him.

Some things besides the name meter are requisite in this machine and if paid for by the consumer he generally procures it from the local plumber, who furnishes the cheapest machine at the highest price of a good meter, and it will probably be a source of dissatisfaction to all concerned, and add much to the cost of maintenance.

The meter must be simple in design, and durable in construction, of material not easily affected by the water in which it must work. It should be so easy to read and compute that any consumer can keep tab on the consumption and test and ascertain if there are leaks on the premises. A meter that is often in the repair shop is very undesirable. Accuracy is necessary, for if the meter is not a close registering machine it will not catch the small flow and consequently may allow leaks to continue without discovery and thus defeat one of the main objects of using the meter.

There are many meters on the market, and some of them are snares and delusions to catch the unwary and unsophisticated water works superintendent, and may disgust him with their unreliability and lack of durability.

Like any other water works machinery or appliances, the best is none too good.

In the cost of maintenance it is certain that the best designed and constructed machine will cost the least for repairs, and consequently the first cost, within reasonable limits, may not cut much of a figure.

The actual experience of cities that have used meters for years will perhaps be the best testimony that can be obtained to show the kind of meter to be used by the city commencing this system.

The first services generally metered are the factories, hotels, restaurants, saloons, livery stables and public buildings; then those residences where lawns are sprinkled, as well as metering street sprinkling carts, and then the placing of a meter on all other users of water.

Perhaps the principal reason for this plan of metering lies in the fact that the larger pipes used by the first class of services waste more water than the residence does; but experience shows that there is about as much waste in many households as in the larger services.

As a general proposition, however, the employes of the factories and larger consumers have but little interest in stopping the waste and leaky services in unmetered premises, and it is only when the employer, who has to pay for this wasted water when metered, gets after this matter that the leaks are looked after and the waste checked.

In the setting of meters the custom is quite general to place the larger ones measuring the use of factories, etc., outside of the metered premises near the curb line and in a vault or box of brick, concrete or wood. These boxes, if built of brick or concrete, are generally, in this climate, as deep as the service pipes and large enough at the bottom to allow of detaching the meter for repairs or changing it, and with a suitable iron cover will cost about seven dollars each, including the cost of setting the meter. If a wooden box is used the expense will be about four dollars each.

There have been several meter boxes put on the market in the last two years, made of iron or tile, facilitating the placing the meters outside of the metered premises, at the curb line, and at a point where they are always accessible by the water department and free from interference by others.

There are, undoubtedly, good reasons for the location of the meter near the curb cock whenever practicable, but it adds somewhat to the cost of installation.

I have investigated several of these meter boxes, some with patented devices, and find them generally well designed and well made of durable materials and adapted to a permanent and economical setting of meters.

The cost of installation with them is less than with boxes built of brick or concrete and but little more than where the meter is set in wooden boxes.

In some forms of these boxes the meter is in a water-excluding and an air-tight box that is clean and dry and at all times accessible to the person and with no liability of interference by others.

It facilitates the reading of meters, and its difference, if any, in the cost of construction will be more than offset by the insuring of the care of all leaks in the service after it leaves the curb cock.

In this Michigan climate, it will cost to set a meter in one of these boxes at the curb line, about six dollars; while in that section along and south of the 40th degree of latitude, the cost would be about five dollars each. Whichever plan is adopted, it is best that the meter be so placed that it can be read easily, and can be removed without any digging or delay.

The meter must be protected from frost and be secured from the introduction of ground water and surface water, for unless this is so, the reading of the meters will be slow and expensive.

As the cost of maintenance is much increased if the setting of the meter is poorly done, or if it is so located as to receive injury from frost or mud, I should advocate the best location and the best material and work in all cases. In fact, it does not pay to use any poor material in the construction of any part of a water works plant; for we are building for the coming generation, and perhaps centuries, and permanent work and material only should be allowed.

When the meter is placed in the cellar of a residence or in the basement of a store or factory building, it must be protected from freezing by placing it in a pit below the bottom of the cellar or by boxing, or covering with sawdust or some other material that will protect it. In the most of these cases, the cost of setting will be about one and one-half dollars each.

At Battle Creek, where the inside setting is done in brick manholes, the cost of setting is about three dollars each.

In the reading of meters, if a general system is in use, a good deal of variation exists between the different plants. Where they are set outside the building at the curb line, about double the number can be read and inspected than if they are set in cellars and in basements. Probably about one hundred per day in the latter case will be the average.

At Lexington, Ky., where all the meters are set outside at the curb line, the superintendent reports the reading of three hundred to four hundred daily, and this is quite an argument for placing the meter outside the premises supplied with water; but in our northern climate in the winter, when ice and snow must be removed from the cover of the box, the outside setting could not be handled as rapidly as in a region where this does not bother, and I think this should be estimated at about one hundred per man daily. The readings, if made monthly and the bills rendered, will be found much easier to collect on acount of the smaller amount of each payment, and where quarterly or semi-annual bills are rendered.

I should estimate the monthly reading of meters to cost 18 cents yearly, allowing one hundred to be the daily reading. The gas companies do this work for considerably less. The office work will not be materially increased in a metered plant. With proper books for recording and numbering and a system of close collections, the work will require no more help than where collections are made on the assessment plan, with its rebates and wrangles over the use and abuse of fixtures, and the less inspection required in the metered plant will reduce rather than increase the office expenses.

In the matter of repairs, a search of the records of many plants that have used meters from ten to fifteen years, shows that about 2 per cent. per year of the cost of the meter is a fair price for depreciation.

Very few of the reports of the cities make as plain as I would like this item of expense; but by personal observation and correspondence I conclude that this is about the right figure. Of course, in cases where carelessness in the setting of meters has caused damage by frost this percentage might be increased. If a good meter is purchased the repairs on it will be less than 1 per cent. for the first five years.

The principal parts requiring repairs in meters of the Worthington type are the pistons, bushings and gearing.

In the disc type, broken discs and worn out intermediate gears furnish the bulk of repairs.

In the rotary and oscillating type the intermediate is the main part to wear.

The cases of gun metal are practically indestructible, and the renewal of the other parts each ten years would keep the cost of repairs less than the figures I make.

Of course there are goods on the market of inferior design and poor material whose life will be ended and they consigned to the melting pot in less than five years. But it does not pay to buy a poor meter or do cheap work in its setting or to be careless about its handling; and as a general proposition the more care taken in its construction and the better material in the meter the longer its life and the less the cost of its repairs.

And when we have purchased a good meter it is well that we put a little more money in its installation and protect it from injury from frost and dirt, remembering always that eternal vigilance is the price of good water and an efficient water works system.

Taking an average Michigan town with one thousand services in use, the cost for meters for the plant and their settings will be about as follows:

Cost of 1,000 meters (all sizes).....	$11,680 00
Cost of setting 16 outside at $7 each	112 00
Cost of setting 984 inside at $2 each	1,968 00
Total cost of 1,000 meters set ..	$13,760 00
Interest on $13,760 at 4 per cent.....	$550 40
Depreciation and repairs at 2 per cent.....	275 20
Total extra yearly cost of meter system	$825 60

Against the other side of this account the saving in fuel alone in a plant of this size will amount to as much as the cost above, and the saving in one-half of the water supply is also worth more than the cost of the meter system.

The time generally taken to meter a plant is about two years, although some towns do it in a year, and some towns take five years. As the best water works authorities have agreed that very soon all water shall be sold through meters, it behooves us all to urge the change of the system of selling water to the meter at once. Hartford City, Indiana, changed its system from the schedule rates to a complete meter system in one year, setting all meters outside in air-tight boxes at the curb line, using five hundred disc meters, at a total cost of about $5,500, including setting. Briefly I will give the results of this transaction:

In 1898 there was 488 taps unmetered, pumping 73,687,475 gallons; in 1899 there were 544 taps partly metered, pumping 64,772,225 gallons; in 1900 there were 605 taps, all metered, pumping 54,767,950 gallons; in 1898 the average pumped per tap daily was 414 gallons; in 1899 the average pumped per tap daily was 326 gallons; in 1900 the average pumped per tap daily was 248 gallons; in 1898 the average revenue per tap daily was $5.74; in 1899 the average revenue per tap daily was $6.25; in 1900 the average revenue per tap daily was $8.51; in 1898 the total revenue was $2,800; in 1899 the total revenue was $3,400; in 1900 the total revenue was $5,147.95.

Decatur, Ind., completely metered the plant with four hundred meters for $4,000, or an average of $10 each, mostly set at the curb line.

The entire cost of metering a water works plant is less than a new pumping outfit will cost, and the wasted water will be saved to supply as many more consumers as the town now has.

And this water we must save and keep, for pure water is getting difficult to find and is going deeper in the ground, and its securing in sufficient quantities is attended with large expense, and it seems as though any men, or set of men, who are competent to handle the $100,000 or more invested in a water works plant, would at once adopt some system by which they could stop the waste and secure the cost of their product.

The cost of the installation of a meter system, while it seems large, is but a small sum when compared to the cost of the wasted water computed for ten years, and unlike most of the municipal debts, that is paid for by the machines themselves.

A HISTORICAL SKETCH OF SLAG CEMENT.*

By Prof. William Kendrick Hatt, Purdue University, Lafayette, Ind.

By Prof. William Kendrick Hatt, Purdue university, Lafayette, Ind.

The following paper gives an elementary statement of the nature and properties of slag cements:

A statement in general of the processes involved in the manufacture of cement from slag material or from limestone and clay material, will make clear the discussion which follows.

A Portland cement, commonly so-called, is made from either pair of the following raw materials artifically mixed together in a finely divided form:

Compact limestone with from 18 to 20 per cent. of clay.

Chalk and clay.

Marl and clay.

Clay-bearing limestone properly dosed with clay or shale, or limestone. This mixture is calcined at a high temperature to nearly the point of fusion. The resultant clinker is ground to a fine powder, and in this condition called Portland cement.

A "slag cement," commonly so-called, is made from the cinder or slag which results when a mixture of limestone and iron ore is burned in the blast furnace. The iron ore

*From a paper presented before the Indiana Society of Engineers.

contains the silica and alumina, which are found in the clay element of the mixture used in making Portland cement. This slag is suddenly cooled, dried and mixed with about one-fourth part of slaked lime, and then the mixture finely ground to form the cement.

Two plants in the United States make cement from slag material by a process similar to that of Portland cement manufacture, that is, the mixture of slag and limestone is calcined to a clinker. One of these, in Pittsburg, uses the granulated slag, mixed with compact limestone; this mixture is finely ground, then calcined in a kiln to a clinker, and ground again just as in the case of Portland cement.—(The other plant, in Chicago, uses a similar process.—Ed.)

For works requiring an early and final strength, Portland cement is usually specified by the engineer. The attempt to use under such specifications certain cements, called Portland cements, but made from a mixture of slag sand and slaked lime, has led to a dispute. On one side we find ranged those who claim that an essential feature of production of a Portland cement is a calcination, or roasting of a certain artificial mixture of carbonated lime and clay to a clinker, and subsequent grinding to a powder. On the other side we find those who insist that the burning to a cinder of the limestone and other material of the blast furnace furnishes a material which, chemically, is nearly a proper mixture for a Portland cement, and that the subsequent correction by addition of a slaked lime paste does not, from the point of view of a definition, involve an error in the case of those who call this product Portland cement.

There are two ways of regarding the dispute. First, from the point of view of a descriptive term it is well to have a separate name for two products which are different in their mechanical and chemical properties. If we desire a sidewalk cement, we should not specify the material by any name which will involve a cement made by the second process above described for slag material, involving no calcination. Nor should we shut out a product like the Pittsburg product, or a similar product made in Chicago.

Second. From the point of view of historic origin it has been pointed out that the original patent for Portland cement involved a double calcination; first of the limestone; then of the mixture of this calcined limestone and clay. So strictly speaking our modern Portland cements have no right to succession to the term Portland.

The cements made by the first process have, however, the right of possession to this term Portland. It would then seem the part of wisdom to divide the cements of this country into three classes—natural, Portland and slag.

Natural will include those made by roasting and subsequent grinding of an argillaceous limestone (a natural mixture of limestone and clay).

Portland will include those made by calcining to a clinker and then grinding an artificial mixture of the proper proportion of limestone (or marl or chalk, or clay-bearing limestone) and clay (or slag sand). The slag cements will include those made by grinding a mixture of pulverized granulated slag and slaked lime paste, which mixture has been made without applied heat.

In the paper below this understanding of the term "slag cement" is intended.

This matter is somewhat important as at least four brands of slag cements as described above are on the market as Portland cements. To ask for a definite classification is not to find fault with slag cements. They have a distinct and high value for many engineering works. Let engineers write the specifications and manufacturers put out their product on the same nomenclature.

The definition of Portland cement above referred to is in conformity with the specifications of the German association of cement manufacturers, the French Ponts et Chaussees, Swiss government, Austrian engineers and architects' association, Russian minister of roads and railways, and recent specifications of the United States engineers.

MM. Brull and H. Henry, in a communication to the Congress for Unification of Tests of Materials before the Paris exposition, July, 1900, have given information concerning the development of the manufacture of slag cement, from which communication the following facts are mainly derived:

In 1898 thirty-six million tons of slag were produced in connection with the manufacture of iron. Many futile attempts have been made to use that by-product. Successful use has been instanced in railway ballast, molded blocks for engineering structures, such as sea walls and embankments, and mineral wool.

In 1737 Belidor in his Architecture Hydraulique had noted that a mortar could be made of pieces of hard brick, splinters of rock and ground blast furnace slag mixed with fresh slaked lime. At the beginning of the century Vicat had noted that certain slags had the properties of pozzuolana (pozzuolana is a volcanic lava which, when mixed with hydraulic lime, forms an hydraulic cement. "Puzzolan" is an imported slag cement used extensively in St. Louis.)

The utilization of slag, however, was not attended with great importance until in 1861 Langen, a founder near Troisdorf on the Rhine, discovered that the slag could be granulated by sudden cooling. Instead of the solid mass of cooled slag, a slag sand could be produced. The effect of this granulation on the pozzuolanic properties of the slag was soon noted. In 1862 at Osnabruck the application of this granulated slag to the manufacture of cement was attempted and the subsequent use of this slag included chiefly the formation of bricks and molded stones by a mixture of this slag sand and slaked lime, a process which has extended itself to many countries.

About 1880 the process of making slag cements on a commercial scale by a cold mixture of granulated slag and slaked lime was inaugurated in the canton of Berne, Switzerland. About the same time certain manufacturers of Portland cements in Germany began to mix a ground slag sand with their product with the result of increasing its strength. It is said that such mixture up to 2 per cent. is not harmful and is practiced at the present day. The sophistications became so general in Germany and England that protests were made against the practice, adulterations of 30 per cent. having been found. The manufacture of slag cement spread rapidly, and at one time there were nine mills in France and twelve in Germany. At the present time, according to MM. Brull and Henry, there are the following mills in operation:

Country.	No. works.	Production (tonnes of 2,204.6 lbs.)
France	10	85,000
Belgium	5	.....
Luxemburg	2	.....
Switzerland	1	.....
Germany	12	180,000
Austria-Hungary	3	100,000
Spain	1	.....
Russia	1	.....
England	2	.....
United States	4	.....

These statistics do not include mills which roast the product in a kiln. Certain mills in Germany and two in the United States have lately transformed or built mills to manufacture this roasted product.

While these statistics are given in the paper of MM. Brull and Henry, it is to be noted that in a consular report to the state department, dated 1895, the statement is made that the slag cement mills are gradually closing down, there being but one mill in Germany, one in Belgium and three in France. This report conflicts with the statement of the paper of MM. Brull and Henry, quoted, and with the account in that paper of the universal and successful use of large amounts of the product in France.

In the United States there are in the author's knowledge nine plants making cement from slag materials, two of these employing a roasting process.

In France (paper of MM. Brull and Henry) the use of slag cement is admitted for bridges and roads, railroads, mines, municipal service. It is allowed by the Administration of Roads and Bridges in hydraulic works; was used in dry dock at Boulogne; used in Metropolitan railroad of Paris; is used in important bridges and tunnels.

A mixture of slag cement and granulated slag is made into bricks, moulded stones, tile pipes. It is said that 60 parts of lime are used by volume with 250-300 parts of slag sand to form the bricks. The pipes withstand a pressure of 71 lbs. per sq. in. and are used in sewers. Pipes are made of a stiff mortar of silicious sand and slag cement.

This cement is not recommended by the manufacturers in this country for such work as sidewalk work, where it is subjected to the influence of the atmosphere when spread out in thin sheets, but it is recommended for foundations, whether for streets, bridges, buildings, etc.

This paper does not pretend to give a detailed account of the process of manufacture. Briefly described the process is as follows:

1. Granulating the slag.
2. Drying the slag.
3. Mixing with desired per cent. of slaked lime.
4. Grinding mixture to powder.

In some cases the slag is ground before being mixed with the slaked lime.

The stream of slag may be run into water, or a stream of water may be brought into contact with the slag as near the outlet as possible; or the slag may be run from the furnace to a trough where a stream of water is flowing. The result is sand, like broken pumice stone, or thin shell pieces of pinkish color, containing 30 per cent of water, or more.

Drying the slag sand is accomplished in a rotary cylinder with inclined axis heated by an interior or exterior flame, or by spreading the sand on sheet iron dryers which are slowly passed through a heating chamber; or else in a vertical chamber with inclined runways of reversed grade, down which the slag runs and is dried.

The limestone is slaked in the mill and mixed with slag in a ball mill.

The materials are ground to an impalpable powder by the ordinary methods of cement manufacture.

The appearance of the slag cement is characterized by a delicate lilac color, in some cases almost white. When cement is

made from slag by a process involving roasting, the cement is of a dark color like that of ordinary dark colored Portland.

It has not the coarse or gritty feeling which characterizes most Portland cement. It works fast, sets slowly and passes ordinary tests for permanence of volume.

A part of the cement exposed to the air has to be well covered to prevent the surface from cracking. After drying out it will exhibit discolorations, yellowish or brown, whereas the part hardened under water will not exhibit such discolorations. The characteristic color of the fracture of a water-hardened briquette is green, but when the briquette dries out the fracture becomes white. The writer has noticed this green color, with a subsequent change to white, in the case of a well-known American Portland cement, and also the discolorations in the pat, indicating slag adulteration, or else a not sufficiently oxidizing flame in the kiln. The green color is due to the presence in slag cement of sulphide of iron, This sulphide becomes oxidized on exposure to the air and changes color. Slag cements contain usually from 0.5 to 1.5 per cent. of sulphides.

It is this tendency to oxidation on exposure to the air, which is destructive to mortar made of slag cements containing an excess of sulphides, and makes it necessary to use the product in underground situations or the interior of thick walls. A parallel test of briquettes hardened in air and water should be made to check up presence of sulphides. This disintegration does not occur in case of all slag cements; it is not a necessary defect.

COST OF EARTH ROADS.*

By Prof. Ira O. Baker, Champaign, Ill.

To determine the amount of money spent upon earth roads, the writer sent a circular to each township in Champaign county asking for certain details as to the receipts and expenditures for road purposes during the year of 1900.

Champaign county is twenty-eight miles east and west by thirty-six miles north and south, and contains almost exactly 1,000 square miles. It lies in the corn belt, and is prairie, broken only by narrow strips of timber along four small streams or "rivers" three of which rise in the county. Most of the land originally timbered is now in cultivation. Farm lands without buildings sell for $80 to $100 per acre. The county contains 153 miles of railroads, or one mile of railroad for each six and two-thirds square miles of area. The population is 47,000, of which 15,000 are in the adjoining cities of Champaign and Urbana.

In Champaign county there is 1.97 miles of public rural highway for each square mile of area. This includes neither streets or roads within incorporated cities or villages, which must be cared for by the incorporation, nor the area of municipalities.

In Illinois three forms of road taxes may be levied, viz, a poll tax payable in labor or cash, a district road tax payable in labor or cash, and a road and bridge tax payable in cash. In computing the poll tax a day's labor of a man is considered to be $1.25, and of a team and wagon or plow $1.50. A team, wagon and driver are then, in law, equivalent to $2.75 per day.

Townships assess a poll tax varying from $1.00 to $2.00 per individual.

There are twenty-eight townships in Champaign county and one-half of them levy a district road tax which in every case is uniform over the township. The levy varied from 10 cents to 50 cents per $100 of the assesed valuation, the average being 25 cents. Nearly all of this tax is paid in labor, only a few non-resident land-owners paying cash. For the townships levying this tax, the average is $8.44 per mile, the range being from $3.51 to $13.39. This tax and the poll tax are usually paid in labor, and, therefore, in half of the townships the total labor tax is $2.49 plus $8.44 equals $10.93 per mile, while in the other half it is $2.49.

For the townships reporting, the average levy of the road and bridge tax was 56 cents per $100 of the assessed valuation, the range being from 25 cents to $1. The average taxes per mile are $23.93, the range being from $11.70 to $34.70.

The total labor and cash is $33.30 per mile, the range being from $16.60 to $52.70. In other words, Champaign county is spending on its country roads in labor and cash an average of $33.23 per mile, the range for the different townships being from $16.60 to $52.70. An attempt will now be made to show what is done with the money.

The townships reporting spent money for new iron bridges, equivalent to $16.20 for each mile of road in the township, the range being from $6.30 to $37.40. The county pays half of the total cost of large bridges, but the above cost of bridges does not include the amount paid by the county.

It seems probable that Champaign is spending more money for bridges than most other parts of the state. Drainage costs

*From a paper before the Illinois Society of Engineers.

$6.32 per mile. Part of this expense was for outlets through dredged ditches, and the most, if not all, of the remainder was for tile drains. Three-quarters of the townships spent money for tile culverts, the average being equivalent to $1.32 per mile of road. All of the townships reported money spent for repairs of bridges and culverts, the average being equivalent to $2.93 per mile of road. Eighty per cent. of the townships reported expenditures for grading (not simply smoothing and leveling), the average being equivalent to $1.43 per mile of road in the township. All report expenses for smoothing or leveling roads (not grading), the average per mile of road in the township being $2.83. The range in this item is very great, being from 40 cents to $10 per mile. Three-quarters of the townships reported cost of mowing roadsides, the average being $1.14 per mile. The total of the preceding expenses is $32.17 per mile of road, or $64 per square mile, or 10 cents per acre.

The average expense is less than the total tax received, since the latter includes expense of administration. Unfortunately no inquiry was made as to the cost of administration and consequently no data can be given.

The expenditures for new iron bridges, tile culverts and drainage amounted to $23.84 per mile, or nearly three-quarters of the total expense, and are for permanent improvements. This work was almost certainly done by contract. If grading be considered a permanent improvement, then $25.27 per mile was spent for betterments. Repairs of bridges and culverts, smoothing the roads and mowing the roadside must be regarded as expenses of maintenance, the total of these items being $6.90 per mile. The writer has a few reports from other townships in other counties in the corn belt, and apparently Champaign county is representative, except that where there is gravel within easy reach they are spending considerable sums to construct gravel roads, in addition to expenditures substantially, as in Champaign county.

In conclusion, a few points deserve brief mention:

(1) Almost three-fourths of the expenditures were certainly done by contract, and, therefore, the criticism frequently urged against the labor system does not apply to this part of the road expenses.

(2.) At present the expenditure for maintenance proper is so small as to make it impracticable to delegate this work to one or more who shall give their whole time to the work. Without some division of labor it is highly improbable that our roads will reach a very high state of maintenance.

(3.) The expenditures for permanent improvements are needed for present conditions, and would be absolutely necessary before hard roads could be introduced.

(4.) Until farmers are willing to tax themselves more than $32 per annum per mile for earth roads, it is needless to expect them to willingly pay for hard roads. Farther, until farmers wear more expensive clothing and live in finer homes, it is unreasonable to expect them to willingly support the most luxurious highways.

ELECTROLYSIS OF WATER AND GAS PIPES.*

By W. W. Brigden, Eng'r and Supt. Water Works, Battle Creek, Mich.

The electric current is made or generated at the power house; it then passes overhead along the feed wires, which connect with the trolley wire, thence along the trolley wire to the car, down the trolley pole, through wires connected therewith to the motors, where considerable electro-motive force or power in the current is expended in propelling the car. The current then passes through further wiring and metal portions of the cars to the wheels and from the wheels to the rails. The amount or volume of current is still the same; that is, there is the same number of amperes, but the pressure or voltage is greatly reduced by the motors. The current then follows the rails to the point nearest the power house and is carried on wires from the rails to the other side of the dynamo from which it started.

In the double trolley system the same process takes place except that there is another trolley pole and another trolley wire alongside of the one which carries the current outward from the power house, and this second trolley wire takes the current back to the generator or dynamo. In the case of the double trolley the current does not get upon the rails or into the ground, water pipes, gas pipes, etc., but is returned to the power house by wires suspended in the air, as is the case with electric light and other similar wires. The process of electrolysis is often quite similar to that of electroplating, although the path of the electric current is not so well arranged for doing the work in the case of the street railway current as is that of the electroplating machine. The current in the case of the street railway is only

* Read before the Michigan Engineering Society.

able to carry the material subjected to electrolysis a short distance away from its source, but is frequently powerful enough to make a heavy deposit on stones, sand and other similar materials at a distance of from one to three inches from the pipe.

Our own home story is always the easiest one to tell, and while it is not nearly so interesting as that of many other places, still it has some points of peculiar interest that may not have come to the attention of any of those present. The city of Battle Creek was one of the first small cities in Michigan to grant a franchise to an electric street railway company. They granted a gentleman a franchise, who shipped in a lot of second-hand flat rails from Cleveland, O., and the balance of his material for construction was very little better. The rails were bonded with iron telegraph wires about one-eighth of an inch in diameter. The trolley wire was small and the cars did not begin to compare with those of today. The original management operated the road for a year or two and then sold out to another party. By the statement of its own employes the company was losing fully one-third of its current in forcing it over the miserable conductors it used. All the wrought iron and lead gas and water pipes in and near the power house were completely destroyed, and the eight-inch water main received considerable injury. The writer has failed to learn of more than one street railway as poorly constructed as this one.

The present street railway line was constructed by a much better class of men, and while they did not provide for the taking care of their electric currents so well as is done at the present day, the construction was fairly good for the year of 1895. Sixty pound tee rails were used and most of the rails were bonded with two No. 0 copper wires at each joint. Experience with the old company led the officers to be on the lookout for damage from electrolysis, and when there was a leak in the water service about five hundred feet from the power house the superintendent made an examination and determined that it was occasioned by electrolysis. There was afterwards a large leak under the floor of the power house. The water from this leak did not pass through the meter upon the premises, but as it was a clear case of electrolysis, a bill was sent to the electric light company, who furnished the railway power, for the estimated amount of water wasted, and the bill was paid. The four-inch water main on the street near the power house was so much injured in about four years that it could be cut in many places to the depth of one-sixteenth of an inch.

Many cities have employed expert electricians to make examinations of the damage that may have occurred from the return currents of the electric railways, and almost without exception some damage has been discovered to water pipes, gas pipes, lead conduits or other similar metallic substances. Battle Creek employed Mr. E. E. Brownell of Dayton, O. He reported much less damage than in other places, but that there were differences in electrical pressure between the water pipes and gas pipes on one hand and the rails on the other hand that would bring about the destruction of the service pipes, water mains and gas pipes within a very few years. The gas company joined with the city in having the electrical examination made and will also assist in any legal proceedings that may be undertaken. No electrical readings were taken at the original examination as to the want of conductivity at rail joints, but since then the superintendent has taken a large number of such readings and has in several cases found at steam railway crossings, etc., places where the drop or difference in pressure would be at times as high as five to eight volts, which means that there was an open circuit, or about such a condition of affairs as would result if a wire was lying on the ground and should be cut in two, leaving the two ends very near each other but not touching. The street railway company is now making a very full and careful examination of rail joints and other places where electrical deficiencies may be found and its experts will soon send in a report. Readings have been taken near where the return wires leave the track and are carried to the new power house, placing one wire in the bottom of a large mill race or canal and the other on the rails, and readings obtained for a few seconds as high as six or seven volts, which shows that a large percentage of the return current was coming back to the power house along the water main which runs under the bed of the stream and along the bottom of the canal which is connected with both the Kalamazoo river and its tributary, Battle creek.

Quite strong electric currents have been found passing along the rails of steam railroads having such irregular and varied direction and pressures that nothing but a complete electrical survey of the entire surrounding district would enable one to have a clear idea of the exact cause of their divergence. Currents have been found that passed directly away from the power house, then were deflected along water mains until they reached a point a mile out of what seemed the proper course for their return, when they suddenly took a somewhat more direct course to their final destination. In several places distant from the power house, where the mains were large, readings taken from the hydrants to the rails, when cars were near and load was heavy, showed

strong currents passing from the rails to the hydrants, which indicated that the current was not getting an easy path on its return by the rail, and in all probability the water mains were receiving small amounts of current at almost every length of pipe, the aggregate of which in a mile or two would be considerable. In Detroit the rope or yarn used for making the joints of a portion of a main that had been cut was set on fire by the passage of the current across the gap left when the pipe was about to be jointed.

Our electrical street railway friends began bonding their rails with an iron wire one-eighth of an inch in diameter. After they found that this would not work it was increased to ¼-inch diameter and made of copper; then to 1-3-inch diameter; then two of the last named bonds were used, and now the better roads are bonded with two copper bonds about ½-inch diameter, or with stranded wires or flattened strips of copper of an aggregate section equal to ½-inch diameter. Bonds are made and have been in use for years that have an electrical carrying capacity nearly or quite up to that of the full section of a 70-pound rail; but these are still given the cold shoulder by nearly all of the street railway companies, and probably none of them are in use in any but the largest systems. Yet, it is asserted by some of the best electricians in the country, and is believed by the writer, that such a bond as this, which would be equal to a piece of solid copper rod about one inch in diameter, would not prevent the return currents of a moderate-sized street railway system from having an undesirable portion diverted to other conductors than the rails. In other words, if the average street railway in a moderate-sized city could have its rails all welded together the current would still escape to water and gas mains.

The use of larger and better constructed rail bonds, and the addition of bare supplementary wires laid between the rails and connected, say every 200 feet, or insulator wires carried alongside the track on poles and connected with the rails every 300 or 500 feet, would greatly improve many of the returns of street railway currents at the present time. Even the running of overhead wires connected to the track in but few places where there was more than the usual lack of returning capacity, would be of value. This has been done in Grand Rapids, Mich., using ten return wires, and is quite successful. But when we understand that there is from one to two hundred up to thousands of amperes of current used by the lines now operated, and that one ampere will destroy 25 pounds of iron, or 75 pounds of lead in a year, and that in many places the rails are returning but 10 to 30 per cent. of their total output, it is easily seen what fearful havoc may be brought about.

Of one thing we may rest assured, better return conductors must be devised, or the great increase in the number and weight of cars will soon make the operation of a single trolley street railway an unbearable nuisance.

If we are to believe the electrical engineers having the greatest experience in investigations of electrolysis, we must accept as a fact their statement that the double trolley system, or an underground system in conduits, well insulated, is the only complete cure known for electrolysis. To be sure, a great improvement can be made in many street railway lines by careful and frequent examinations of all joints and rails and a correction at those places found deficient, and this may be sought as the only available remedy at present.

It is doubtful whether there is any economy in the construction and operation of a single trolley line as against the double trolley except in the matter of original cost, and there the difference does not exceed $1,000 per mile. In fact, if the rails are bonded to the extent that the best authorities recommend, the chances are that the cost would be fully as great for the single trolley as for the double trolley. No bonds are of any use where the double trolley system is adopted. The Cincinnati street railway lines have two hundred miles of track, and their management says that the original system of double trolley line has been so satisfactory that several single trolley lines, which have been purchased and added to the system, have been changed to the double trolley and the company is satisfied that there is an economical saving over the single trolley in their expenditures for maintenance. All new street railways in the suburbs of Washington, D. C., are required to put in the double overhead trolley system, and in the central portions of the city the conducting wires are required to be placed in underground conduits carefully made and with the wires well insulated.

It is the belief of excellent authorities on water works construction and maintenance that the life of a water pipe in the average soil will be at least doubled or trebled by the addition of a coating of coal tar pitch or similar preparation put on at a high temperature. A six-inch gas pipe in Battle Creek which has been in use for thirty years shows no sign of rust on its exterior surface, and there seems no reason why a water main should not last equally as well. Where electrolysis takes place, even to a moderate extent, this coating is so far destroyed that it loses nearly or quite all of its value as a preservative. It takes but a very small portion of the cur-

rent of a street railway to injure this coating. If the water pipe is near the rail it might readily be done with a difference in potential not exceeding one-fourth volt. No water system in the United States has received so great injury as that of Dayton, O., where over two miles of water main besides many services have been so badly injured as to probably require their speedy removal. This city has brought suit against the street railway company for $70,000, and since the filing of the original suit has added several thousand dollars to the original bill. The natural gas company of Indianapolis, Ind., began a suit against the street railway company, which has greatly injured their piping system. The local court decided that a remedy was available to the street railway company, but no remedy was available to the gas company, therefore, the street railway company was liable for damages and must apply the proper remedies or pay the same. The suit was for $50,000 damages and the natural gas company seemed to have proved that damage had actually taken place, but the street railway company still held that it was not liable. The case was carried up to the Superior court, the street railway company demurring to the ruling of the lower court. Judge Carter of the Superior court overruled demurrer and practically decided that damages must be paid. It is thought that the street railway company will appeal to the Supreme court of the state. If it does, let us hope that an early decision will be rendered. The water company of Indianapolis is also preparing to bring suit against the street railway company, and it is claimed that great damage has taken place. The officers of the company are unable to state how much, as it would require an expensive examination to even approximate the amount. Suit has been brought by the Peoria, Ill., water company against the street railway company in that city asking for an injunction to restrain the street railway company from allowing its currents to get upon the ground in any manner.

Franklin, O., where great damage has been done to all pipes on one side of the river by a suburban line passing lengthwise through the town, has begun suit and expects soon to bring the case to trial. The Spokane Falls Gas Light company brought suit some time ago against the Spokane Street Railway company. It was decided by the county court that the street railway company must within six months apply either cast iron welded joints or Chicago bonds to various parts of its line. It was contended by the gas company that the double trolley system should be adopted as that was the only known means of preventing stray currents from getting on gas-pipes. The street railway company, of course, did not want to be compelled to do anything. The decision seemed to have been in the nature of a compromise between these views, and was so unsatisfactory to the gas company that, although it had practically won the suit an appeal was taken to the Supreme court, but no hearing has yet been had before that court. In the meantime most of the experts who had examined the welded joints have decided that while it is a good mechanical appliance for carrying the car wheels over joints it is anything but a success as an electrical conductor. The Chicago bond which is a bundle of small wires with an annular terminal or end piece made to fit in a hole bored near the end of the rail, through which a pin is driven which expands it to the full size of the hole, has been partially displaced by similar forms of bonds with a solid and longer terminal which is expanded by a strong hand power machine made for the purpose. Several suits have been started and are under way in other cities and in a few places street railway companies have paid moderate sums for damages produced by electrolysis. The apathy with which municipal officers especially act, who would otherwise have great influence in compelling a proper decision, is greatly to be regretted. It is partially with a view to correcting this evil that agitation on this subject should be kept up by all those who desire a proper solution of the problem.

The damage to gas mains is still greater than to water mains, because the perforation of the gas pipes produces leakage, which, passing into the basement of the buildings is ignited, and an explosion takes place that in several places has wrecked the buildings.

The question is frequently asked what legal action shall be taken by legislative bodies in order that there shall be at least a lessening of the injuries due to electrolysis in the future. The question is easily asked, but a law that can be practically carried out is not easily devised.

It is said that several state legislatures will have before them during this winter's session, for passage, bills providing for exemption from damages due to electrolysis.

Battle Creek has passed an ordinance which is more full and complete than any the writer has seen. The main points of the ordinance are that all new lines shall be provided with a double trolley, and that should any line be allowed by law to use the single trolley system it shall be required to put in a very complete and expensive bonding. It is believed that a street railway company could put in a double trolley system at least as cheap, if not cheaper, than it could comply with the bonding required by this ordinance. It was not expected that the bonding as set forth in the ordinance would be strictly followed, but if the single

trolley system should be allowed the best known bonding at the time could be secured in lieu of that required by the ordinance. This ordinance also fixes the maximum difference in potential or voltage that may occur at any time between the gas pipes, water pipes and other similar substances on the one hand, and street railway track on the other hand at one-fourth volt. This is a very close restriction for a single trolley railway, there being in Battle Creek occasional momentary readings of five to eight volts, and several places where the average would reach two to four volts in the summer time, when the travel is heaviest.

In many cities there is a difference of voltage, or pressure, as high as twenty or thirty volts, and there are some cases where it has largely exceeded these figures. The ordinance also requires all street railway companies to make full and complete electrical examination of their return conductors every six months and furnish copies of the results to the proper city officials. In case the examination shows deficient conductivity it is required to be made good within three months of the date of examination. The best and most modern devices for conveying electricity are required to be installed and used. Street railway companies are made responsible for damages and proper penalties are attached for failure to comply with the conditions of the ordinace.

There are 18,000 miles of electric railway and 50,000 cars in the United States, which is nine times that of the year of 1900.

It is the opinion of the writer that almost every small town in Michigan will, in a few years, have its electric street railway lines, and should there be no improvement made so that some other and better means of transportation—such as the automobile may possible become—is devised, the state will be gridironed with these lines within the next ten years. Municipalities and water and gas companies should, therefore, do the utmost possible to reach the proper remedy for the evils due to electrolysis soon, and should then place on the statute books such legislation as will bring about a complete change in the present methods of returning the currents of street railways. In Ft. Wayne, Ind., 1,000 feet of twelve-inch water mains was removed because of the damage done from electrolysis. It has not been stated publicly what the damage aggregated, but if on a well-paved street it certainly could not be less than four or five thousand dollars, supposing that the service pipes were also injured, which is more than probable. There are not less than seventy cities which have publicly stated that the damage had been done by electrolysis, and at least one prominent electrical engineer affirms that in his opinion there is not a single city where the single trolley system is in use that damage has not taken place.

In reply to a circular letter sent out by the writer to thirty-five cities, replies were received from fourteen. Several had not even investigated the matter of electrolysis. Five or six had given the matter most serious attention—most of them having had examinations made by experts. These nearly all report damages to either water or gas pipes, in some cases the damage being almost entirely confined to one set of pipes. The superintendent of the water works of Cincinnati reports no damage since all of the lines in the city have been put under the double trolley system. He seems so confident of safety that he has given the matter but little attention for several years past, although no doubt called upon to give his opinion as to the value of the system as used in his city. He reports serious damage on a single trolley line that has lately been changed to a double trolley.

Nearly all report no legal action either past or contemplated, although four or five have some provision in the franchise granted the street railway company, by which it would be partly or wholly responsible for the injury done pipe systems. Some have tried to get ordinances passed and failed. Only three reported having been paid for damage done, although three others had presented bills, which were refused payment. Several were only seeking exemption from future damage and would be glad to let the past go if that was accomplished. Several stated that they would join with other cities and water and gas companies to procure legislation prohibiting street railways from returning their current in water and gas pipes, while others were doubtful as to their authority to agree that this should be done, but otherwise appeared willing. To the question as to whether the street car company had negotiated with water works and gas companies in a spirit of fairness and with readiness to do those things that would bring about better results, the replies of several indicate no negotiations with the street railway company, or no necessity of any. One replied that the negotiations were all that could be expected; that they were entirely fair. Peoria, Ill., reports that the water company offered to pay one-half the cost of the change from single to double trolley, up to $10,000, for its half, and to waive all claims for past damages. This offer was rejected, so suit was brought. One reports that he has not and never will negotiate with the street railway company. In this same city the gas company has brought suit for $50,000 damages, and the water company is preparing to take similar action. Judging from the information that is available to the writer, about one-half the street railway companies meet the water

and gas companies in a spirit of fairness and with at least some attempt to remedy the evils complained of, while the other half resist with more or less tenacity every attempt to bring about a better condition of affairs on the part of those injured, and in some cases go so far as to utterly ignore every attempt that the water works or gas companies can devise to collect damages for past injuries or to protect themselves in the future.

CURRENT INFORMATION

Massachusetts Highways.

The eighth annual report of the Massachusetts highway commission, which is composed of W. E. McClintock, Harold Parker and John H. Manning, has been published. The report states that the most serious defects in the old town highways which are reported for improvement, are the heavy grades. These are not only a tax on the user, but a constant and burdensome cost to the municipalities caring for them. The wash of storm water is much greater on heavy than on light grades, as is also the wear and tear due to the horses' feet. Taken as a whole no one improvement makes a better return for the money invested than the cutting down of hills. Whatever is done in this direction becomes of permanent benefit, and whatever the character of traffic, does not need to be done a second time. By carefully grading a road throughout its entire length between two centers of population or business, the possible load is increased notwithstanding no particular effort be made to improve the surface. The commission with these facts in mind is finally convinced that frequently more immediate benefits will result from laying out longer sections of state road at one time, and doing the grading on these sections in advance of the gravel or macadamized surface. The commission is also satisfied that the cost of carrying on the work can be materially decreased under such a system, as it will be possible to advertise larger quantities of each class of construction.

The commission employs about the same methods of construction now as those first used. With the exception of peat, muck and vegetable loam, experience has shown that all soils in the latitude of Massachusetts make a good support for roads during the greater part of the year. Sand, gravel and porous soils give no trouble at any time, while clay, sandy loam and all non-porous soils are much weakened by frost action, and in their natural condition afford poor support in the spring months, although they can be greatly improved by removing the ground water from them. The committee estimates that non-porous soils, drained of ground water, will support in their worst condition a load of about four pounds per square inch, and the thickness of the broken stone is adjusted to the traffic on this basis. If a division of the load in pounds at any one point by the square of twice the depth of the stone gives a quotient of four or less, then the road foundation will be safe at all seasons of the year. On sand or gravel, the commission believes that twenty pounds per square inch may be safely placed. Acting on this theory, the thickness of stone on state roads varies from four to sixteen inches, the smallest thickness being placed over good gravel or sand and the greatest over heavy clay. Where the surfacing exceeds six inches in depth, the excess may be broken stone, the choice depending entirely on the cost, for all are equally effective.

All broken stone now used on the Massachusetts state roads is separated into three sizes by passing it through a screen with meshes one-half-inch, one and one-half and two-and one-half inches in diameter. The sub-grade and each course of stone are thoroughly rolled, and the top course is watered before rolling.

The money invested in crushing plants in the state is estimated at $574,000. All of these plants, whether employed in state or municipal work, are fitted with elevators and revolving screens so that the stone passes through the crusher, elevator and screen into the bins, and from them into the carts without rehandling. Particular attention is paid by the engineering department to the selection of the rock for the roads, traffic, first cost, and cost of maintenance being taken into account.

Trap rock is considered the most economical material for the surface of roads with heavy traffic. Where it has to be moved long distances and its cost is high while a low-cost native stone is available, the latter is used as a bottom course and the trap rock for the wearing surface. In a few cases the native rock surfacing has not worn well, the cost of maintenance has been considerable and the surface of the road has become rough. These have been broken up by picks in the wheels of steam rollers, evened up, and resurfaced with two to three inches of trap rock with the proper amount of screenings, water and rolling.

All state roads are compacted by the use of steam rollers during both construction and permanent repairs. The steam roller is

believed to give quicker, better and more economical results than can be obtained by any other method, with a properly prepared sub-grade; and by rolling the sub-grade and each course of stone separately no difficulty is experienced in using steam rollers that cannot be overcome easily. At the close of last year $429,000 was invested in steam rollers in the state, seventeen owned by the commonwealth, 102 by municipalities, and forty-three by contractors.

The standard width of broken stone roadways built by the commission remains fifteen feet, and on each side there is a width of three feet shaped to the same cross-section as the broken stone. These side strips or shoulders are covered with gravel on much-traveled highways only; on all others, the natural soil is used. Roadways of ten and twelve feet have been built and are satisfactory so far as their use is concerned, but the ten-foot roadway cannot be maintained economically except where the traffic is exceptionally light. Guard rails, to protect the traveler, are placed on embankments and at culvert ends. Where the cost is not much increased, the embankments are given a slope of one on four and the rail is omitted.

Paved gutters have not been laid as a part of construction since 1897. They are only built now where the gullying of gutters can be prevented in no other way. Either iron or vitrified clay pipes are used for culverts, up to twenty-four inches in diameter, the ends being in all cases protected by stone masonry. The larger culverts are built of rubble masonry, the side walls being laid dry and the ends in cement mortar. The commission lays much stress on the need of good materials and workmanship in all culvert masonry, for while the first cost of good work may be greater, the final cost is surely less.

Reference has already been made to the necessity of removing ground water from the sub-grade of the road. This drainage is effected in various ways, the kind of drain being dependent on the character of the soil. That most used by the commission is a vitrified clay pipe laid with open joints in a trench three to three and one-half feet deep and twelve to sixteen inches wide. The pipe is placed on a two-inch layer of fine gravel, free from sand or dirt, and is surrounded and covered to a depth of six inches by the same kind of gravel. The remaining part of the trench is filled with stone from one to three inches in diameter. Such a pipe is found to remove the water quickly to an outlet; the fine gravel allows a free flow of water, and at the same time prevents the passage of silt into the pipe; the removal of sand or dirt from the fine gravel surrounding the pipe removes the possibility of its entering the pipe; and the coarse stone in the upper part of the trench intercepts the ground water in its flow toward the sub-grade. These drains are placed on either or both sides, as the contour of the ground requires.

There are many of the main roads that might well be surfaced with gravel, and its use would satisfy the requirements of the traffic. In Massachusetts, however, good road-building gravel is a scarce article in comparison with stone. Its use is practically prohibited when the supply has to be carted more than one and one-half miles, or when screening is necessary to remove a surplus of fine sand or of coarse stone. Some of the gravel roads have been made from the material as it came from the bank. In other cases it has been separated by screens with meshes one-half inch, one and three-quarter inches and two and three-quarter inches in diameter, each size being spread and rolled separately. In still others, the gravel from the bank has been run through the crusher, broken and screened, and laid in courses and rolled in the same manner as broken stone.

Three years ago an interesting experimental road was built in Truro, near the extreme end of Cape Cod, and has proved a success. The soil here is loose sand with practically no surface loam. The drainage is perfect. There is not much snow or frost during winters, and the traffic is light and small in volume. The loose sand sub-grade was shaped to the desired cross section, and on this was spread a natural mixture of 1 per cent. sand and two parts of clay; this layer was two inches deep. Over it was spread a three-inch layer of stone broken to sizes ranging from one-half to one and one-half inches. This broken stone was covered with a one-inch layer of clay and a long-toothed spike harrow was dragged back and forth until the clay and broken stone were well mixed. The entire surface was finally watered and rolled with a two-ton roller, and since its completion an occasional sprinkling of sand to prevent the clay from becoming muddy is all the work that has been needed to keep the road reasonably smooth and free from loose stone.

The experience of the commission has convinced its members that better results are obtained and money is saved by maintaining the roadway in good condition at all times by a system of continuous small repairs, rather than leaving it until it is practically worn out and then thoroughly rebuilding. The commission is also convinced that a thorough consolidation by a steam roller in the spring, after the frost is out, but before the sub-grade is dry, is one of the best means of keeping a stone road in good condition.

For ravelling and the loose fragments of stone scattered over the surface of a roadway in consequence, the commission has

found that sprinkling sand over the surface as often as needed has given a greater degree of satisfaction than any other remedy. This coating of sand is a small fraction of an inch in thickness and is spread over a width of about eight feet in the center of the highway. Treatment several times during the year is required by some of the roads exposed to the wind, while others with less exposure need but little attention. Heaps of broken stone are scattered alongside most of the state roads to be used as occasion requires in filling slight depressions or for emergency work.

Charles Mills, chief engineer of the commission, has carefully investigated the wear on the state highways. Cross-sections were taken at forty places and it was found that the elevation was 1.03 inches lower on an average than the original elevation. The figures for roads built in each year are shown in the following table:

Year built.....	1895	1896	1897	1898	1899
No. of sections..	7	9	12	7	2
Crown Ins. per ft. original	0.694	0.583	0.645	0.625	0.688
In 1900.....	0.500	0.514	0.500	0.500	0.625

While the roadway is of first importance, the commission has not lost sight of the educational effect of a well-kept roadside. The space on either side between the roadway and the boundaries of the right-of-way has been cleared of debris and generally smoothed up. Trees that would afford shade or add beauty have been carefully preserved and the planting of shade trees has been encouraged. On two of the state roads, eight and eleven miles long, men are employed who spend their entire time cutting brush and weeds, cleaning waterways and gutters, trimming down shoulders and filling washouts.

New Jersey Road Improvements.

The seventh annual report of Henry I. Budd, state commissioner of public roads for New Jersey, for 1900, has been published. An instructive addition to the report is a large road map, showing the free and toll roads built in New Jersey under the law, where these improved roads are, and how much has already been accomplished. The pressure for new roads in New Jersey is so great, says Mr. Budd, that the people are constantly building ahead of the state appropriation. Last year, while the appropriation made only authorized the construction of eighty miles of road, about 140 miles were actually built or are under construction. Mr. Budd, in view of this public demand for highway improvement, recommends an increase in the annual state appropriation from $150,000 to $200,000. He suggests, also, that the state aid law be so amended as to allow the counties to raise one-half instead of one-quarter of one per cent. upon their ratables. While this latter amendment was once passed by the legislature but failed of approval, yet the present condition of the state treasury and the 30.3 per cent. rate of increase shown by the last census would justify its re-enactment. The increased cost of road construction in New Jersey is explained by Mr. Budd, who says that the price of labor has advanced about 20 per cent.; the railroads advanced their charges from 10 to 20 cents per ton. A combination among the quarry owners made the average ton of stone in the road bed cost at least 50 cents more than the previous year's quotations. These increases have made the roads in the southern and central portions of the state, which are distant from stone quarries, cost fully one-third more than before.

The question of gravel vs. broken stone for road construction in Monmouth county is being discussed, as a result of the increased cost of broken stone. Public sentiment seems to approve of the gravel construction as being much cheaper at $1,499 per mile than $8,571 for stone, and as wearing well and being more cheaply kept in repair.

The tendency of improved roads and trolley lines, Mr. Budd points out, is to scatter the population, and is gradually relieving the congestion of large cities. He says:

This is shown in the decrease of rentals near the center of the cities, from one-third to one-half, and the increased value of suburban property for rental purposes. Free rural mail delivery, recommended by the postmaster-general, will add to the advantages accruing from better roads.

He says that while roads in different parts of the state are constructed of varying depths, some of telford and most of them of macadam, experience has shown that the most satisfactory roads are made with six inches of macadam and fourteen feet wide. These roads are made of two layers of stone, each four inches deep, rolled down to six inches. The plan of building these roads by blocks, or placing cubical blocks four inches in size, and requiring all loose stone to be filled to the surface of the blocks has been adopted by the engineers. This insures at a glance the proper depth of stone.

Embodied in the report are two contributions by R. A. Meeker, state supervisor, upon road materials and the maintenance of macadamized roads, and other special articles.

Standard Specifications for State Aid Roads in New Jersey.

The standard specifications for roads built under the state aid laws have recently been revised by the association of state and county road engineers of New Jersey.

Plans, profiles, cross-sections, specifica-

tions and estimates of quantities in sufficient detail to enable a bidder to submit a lump sum tender for the entire road construction, must be furnished by the engineer. The bid, however, must be accompanied by an itemized price list from which the monthly payments can be made out. These amount to 80 per cent. of the work done; of the remaining indebtedness, 15 per cent. is paid when the work is accepted and 5 per cent. is retained as a guarantee fund that the contractor will keep the road in repair for one year from its acceptance, which is a part of his contract. The accuracy of the estimates of quantities is not guaranteed by the county, nor are any important deviations from the plans or extra payments permitted, except by a written agreement of all parties, including the state commissioner of highways. It is particularly specified that on all drawings, figured dimensions shall be accepted in all cases of discrepancey between scale and figures.

The revised specifications contain the following requirements: The roadway excavation must be made to the lines shown on the drawings. The soil must not be removed from the line of the road without the engineer's permission, and he alone may say where it may be placed; generally he sends it to the embankments, either for the roadway or sidewalks. The embankments are formed in layers of such thickness, usually 12-ins., as the engineer orders, the correct allowance for shrinkage being added. All slopes of cuts and fills are 1-½ to 1, except when otherwise ordered by the engineer. The contractor is required to leave or make, on each side of the finished roadway, a shoulder of firm earth, which will prolong the surface of the carriageway to the side ditches. This shoulder is rolled as the engineer requires. The side ditches are staked out by the engineer as needed. Four-in. tile underdrains with joints covered with salt hay or equivalent material are laid on one-inch plank six inches wide, where he may designate, or a stone drain may be used. This is made by filling a trench one foot wide and one and one-half feet deep with loose, broken stone. When the excavation and embankment are finished, the surface must be rolled until approved by the engineer, all depressions being filled and poor material removed as the work progresses. Water is sprinkled in advance of the roller when the engineer directs, and the roller itself for this and other parts of the work must be of a weight fixed in the specifications for the work or by the engineer. General requirements are provided for all classes of telford and macadam, although the thickness of the various courses is given in the specifications. Where a telford foundation is to be made they provide the following:

It is to be set by hand as a close, firm pavement, the stones to be placed on their broadest edges lengthwise across the road in such manner as to break joints as much as possible, the breadth of the upper edge not to exceed four inches. The interstices are then to be filled with stone chips, firmly wedged by hand with a hammer, and projecting points knocked off. No stone of greater length than ten inches or width of four inches shall be used, except each alternate stone on outer edge, which shall be double the length of the others and well tied into the bed of the road; all stones with a flat, smooth surface must be broken; the whole surface of this pavement to be subjected to a thorough settling or ramming with heavy sledge hammers, and then rolled. No stone larger than two and one-half inches is to be left on top of the telford.

In macadam roads the first course is to be of 2½-inch stone, or such as will pass through a 3-inch ring. No stone is to be less than 2 inches long. This course must be watered in front of the roller when the engineer so requires. The depth of the loose stone in this and other courses is to be fixed by blocks of the desired thickness placed on the sub-grade at frequent intervals while the stone is being spread. Binder is spread uniformly on this first course and rolled, with sprinkling if so directed, until the stones cease to sink or creep in front of the roller. The quality and quantity of the binder are subject at all times to the approval of the engineer.

The second course is to consist of 1½-inch stone, that is, such as can be passed through a 2-inch ring and is from 1 to 2 inches long. This is spread, rolled and covered with binder like the first course.

When the two courses have been finished satisfactorily, a coat of 50 per cent. of ¾-inch stone and 50 per cent. of screenings, properly mixed, is to be spread of sufficient thickness to make a smooth and uniform surface to the road; then rolled again until the road becomes thoroughly consolidated, hard and smooth. Depressions are to be filled with fine stone and screenings, and water is to be used when the engineer so directs. In rolling, the roller is to start from the side lines of the stone bed and work toward the center, unless otherwise directed, and this part of the work is to be modified as much and as often as the engineer directs.

For stone the requirements are:

All stone must be as nearly cubical as possible, broken with the most modern crushing machinery, free from all screenings, earth and other objectionable substances, of uniform size, and the same kind and quality, or equally as good in every particular, as that shown in the engineer's office. The 1½-inch stone, the ¾-inch, and screenings for binder and finish must be of the best trap rock, free from loam or clay.

The specifications contain a clause relative to the old marks of boundaries of property, which is as follows:

The contractor shall not disturb the position of title stones .(the corners of property adjacent to the road) but where they appear he will either lift or lower them, under personal supervision of the engineer.

Illinois Central's Good Roads Special.

The National Good Roads association began, April 16, its first practical demonstration of road construction on its southern trip at Flossmoor, Ill., thirty miles south of Chicago. The "good roads special" consists of seven flat cars, bearing scrapers, sprinklers, a rock crusher and rollers, and a commissary and officer's car. Accompanying the train on its trip south were Senator Martin Dodge, director of public road inquiries of the United States department of agriculture; R. W. Richardson, secretary of the National Good Roads association; W. T. Beatty, representing the road machinery manufacturers; Prof. W. R. Hoag of the engineering department of the University of Minnesota.

How to Lay Tar Macadam.

Mr. W. C. Wingate, City Engineer of Hamilton, Ont., describes the method of laying tar macadam, and the results, as follows:

Last year our city constructed about 70,000 square yards of tar macadam roadway, costing $75,000, including curbing, which is half of the $150,000 fund that was voted on and appropriated for this purpose, leaving $75,000 more to be expended in similar work this year. Tar macadam was constructed by corporation labor and none by contract, and cost in the neighborhood of 95 cents per square yard, based on labor at 18 cents per hour and refined coal tar delivered found on board cars in Hamilton at $3.75 per barrel of 50 United States gallons. During the year 1899 there were about 4 miles of this class of pavement laid by corporation labor, and costing not quite 80 cents per square yard, but this was based on labor at 15 cents per hour and coal tar at $2.60 per barrel. The stone used is of a hard bastard limestone, quarried within the city limits and with an average haul of 1½ miles, cost about $1.15 per cubic yard for the hand broken stone, and 95 cents for the machine broken or crushed stone delivered upon the site.

The advantages claimed for this pavement are that it is free from dust, easily swept compared with plain macadam, and, owing to the tar mixture causing a complete adhesion to the stone, making it impervious to water, and thereby holding the pavement in a permanent position as originally laid, and no moving or rolling of stone as often experienced in a plain macadam roadway. I might mention also that there is no wear to the top dressing, as it is calculated that the latter will soon either peel off after evaporation sets in, or crumble away, leaving the large stones as a wearing surface. The dressing is merely intended to be evenly spread over the tar macadam and well rolled in with a heavy steam roller, and, as before stated, making the surface compact and close and impervious to water. With reference to the durability or lasting qualities of this class of pavement, I do not feel that I am yet in a position to say definitely, owing to the short time it has been laid; but I have every reason to believe that the same will prove durable, fairly clean and free from dust, easily swept, and will require to be repaired only every third year on the principal streets where the traffic is heaviest, and on residential streets, where the traffic is light, every fourth or possibly fifth year, by spreading a new coating 2 inches thick of tarred stone with dressing on the full width of roadway, and at a cost not to exceed 25 cents per square yard. This, you will observe, divided by three years, would be 8 1-3 cents per square yard annually for the principal traveled streets, and for the residential streets from 5 to 6¼ cents per square yard.

The first tar macadam laid by the city of Hamilton was laid in the year 1880, a little over 20 years ago, on Mulberry street, one block of about 400 feet, by the Hamilton Gas Light company's people, and although this pavement is not in first-class condition today, an expenditure of 25 cents per square yard would make it nearly equal to a new roadway. There has been little or no expense on this pavement during all that time. The second tar macadam was laid in 1891, on West avenue, of about three blocks, or 1,200 feet, 22 feet in width between curbs, one of our principal residential streets, but the traffic was fairly light until the year 1896, when a large building, the Collegiate Institute, was constructed, necessitating the carrying of much heavy material over this street, and it was surprising the way the tar macadam stood the wear, the repairs of which have been only nominal, being a few holes that were patched up, making a pavement as good as formerly. These two latter pavements were laid in a most primitive way, and not to be compared to the manner in which we are doing the work now under the revised specifications; but notwithstanding the inferior work at the time, it is proving to be an economical roadway and has been the cause of our taking up the question of better pavement and the adoption of tar macadam. A third pavement with a somewhat better specification of tar macadam roadway was also laid in the year 1893 by the Hamilton Gas Light company's people, with a 10-year guarantee for maintenance of same, on King William and John-sts., two principal streets near the heart of the city, over which much heavy traffic passes, for a total distance of 4 blocks, or say 1,600 feet, for the sum of $1.75 per square yard. This pavement had little or no repair until the year 1899, when an arrangement was made with the Gas Light company, and the city was directed to make the necessary repairs and charge to them, the same having been completed over half of the distance and costing 31 cents per square yard; which, distributed over 6 years, from 1893 to 1899, would be 3½ cents per year.

In this connection it might be well for me to mention that many deputations from various cities throughout the United States have visited us during the past two years on inspection trips for the purpose of seeing for themselves this pavement as laid on our streets, and so far as I can ascertain they have all been favorably impressed, and I have heard from several

stating that they had concluded to adopt tar macadam in their own cities.

I am aware that tar macadam is not a new thing, as it was used years ago in the old country with more or less success, but in the states it has generally proved a failure, particularly so in Washington, where it was tried and failed in the year 1871. Very recent cases have been tried in the state of New York after parties had visited us and tried to do as we had done, but I have learned that it was a partial failure, and upon request I sent a man from here to help them out of the difficulty the best he could, which he succeeded in doing.

These failures are caused by not having the proper knowledge pertaining to the tar mixing, which is essentially a job that must be left to the discretion of the man in charge, as it is quite difficult to fix any hard and fast rule, as so much depends upon the quality of the tar, the temperature while heating, the dryness of the stone and the quantity of pitch. Then, too, it is absolutely necessary to have hard, porous rock which is found in the limestone. With the use of broken granite for a tar macadam roadway one would have very little success, owing to granite being so close grained that it will not absorb the tar, unless thoroughly dried and baked on hot plates, which makes it expensive.

Pavements in Michigan Cities.

A committee was appointed recently at Hillsdale, Mich., to visit the different cities in the state of Michigan for the purpose of examining the pavements in use, and to ascertain their cost, relative merits as to durability, practicability, desirability, etc. Mayor H. C. Blackman, chairman of the committee, states in the report that owing to the fact that for almost the entire period of time that has elapsed since the committee was appointed snow has covered the streets of all the cities of Michigan, the committee, deeming it unwise to secure the information desired by visits to these cities, has procured by correspondence a valuable fund of general information on the question of pavements from mayors, clerks and city engineers of the cities addressed, which, summarized, is as follows:

Kalamazoo—Uses brick, asphalt block and macadam. Advises use of brick on business portions. Cost, brick, $1.61 per square yard; asphalt, $2.17. Laid by city. Foundation, concrete under brick, sand and asphalt. Holds its evenness of surface (the brick) on concrete foundation, and gives no trouble in restoring surface after excavating for water, gas, etc. Basis of assessment, one-third borne by city, two-thirds by abutting property.

Coldwater—Uses brick and considers it best for towns of its size. Cost, 1898, $1.35 per yard; 1899, $1.28 per yard. Laid by contract, on six inches of concrete. Holds its quality of surface fairly well. No trouble to restore surface after excavation. Two-thirds of cost assessed against abutting property.

Monroe—Uses repressed block, and considers it good. Laid on crushed stone, twelve inches. Holds its surface well. Thirty-five per cent. of cost assessed against property.

Big Rapids—Uses cedar block, laid on sand and boards. Has not retained its evenness of surface; trouble with restoring it after excavation. Cost not stated.

Saginaw—Uses brick and asphalt. City engineer considers asphalt best known pavement when in proper condition, but very expensive to keep it so in our climate. Renders it an expensive luxury. Brick more durable and less expensive and for these reasons preferable on business streets. Cost: Asphalt, $1.52 to $2.90; brick, $1.30 to $2.75. Most of their pavement laid by contract, and on 6 inches of concrete. No trouble with either in restoring surface after excavation. Both hold equality of surface. Cost borne by the property especially benefited, except street intersections, borne by city. Five or ten-year bond issues.

Jackson—Uses brick and considers it best. Cost: From $1.70 in 1891, to $1.24 in '97 and $1.34 in 1899. Laid by contract. Foundation, in 1895, and prior thereto, sand and gravel; subsequent to 1895, on 6 inches concrete. Holds its evenness and equality of surface on the concrete. Main street, which was not laid on concrete, very uneven as result of excavations, etc. On concrete much easier to restore original surface after excavation and retain its original evenness; no inequality need result if care is taken in restoration. Property-owners pay four-fifths of cost, city standing expense of alleys and street intersections.

Pontiac—Uses asphalt block and considers it best. Cost, $1.77 per yard for material. Cost of laying pavement not stated. Laid by contract on concrete where there is heavy traffic and gravel elsewhere. Holds its equality of surface. Easy to restore after excavation—city clerk says easiest on the market. City bears one-sixth of expense, street railway "their portion," and property-owners the balance.

Benton Harbor—Cedar block and brick. Considers brick or asphalt best. Block cost $1.20 per yard and 48 cents per foot for stone and curbing; brick 90 cents per yard. Block laid on sand and boards, brick laid on sand. After one year's service, brick holds its surface "fairly well." Difficult to restore surface after excavation. Abutting property pays, 4-5 of expense. City also has one-half mile of asphalt, put in a few months ago at a cost of $1.73 per square yard, and 50 cents per foot of curbing. Considers it best in many respects. Difficulty of restoring surface seems to refer to cedar block, as other pavement has not been laid long.

Ypsilanti—Uses Metropolitan shale brick, which cost from $1.92¼ to $2.21 per square yard. Laid by contract, on concrete. Ten blocks laid from one to two years. Holds equality of surface. No difficulty to restore surface after excavation. Abutting property-owners pay all of expense except street intersections. Have privilege of paying in nine years, or ten installments. Interest on deferred payments at 5 per cent. per annum.

St. Joseph—Uses brick, and considers it best for business portion of city. Price not given. Laid on sand, well packed.

Surface remains even after five years' use. Cost assessed against abutting property.

Owosso—Uses asphalt with brick gutters. Considers sheet asphalt best. Cost, $1.53 per square yard for asphalt and $1.40 for brick. Laid by contract on concrete. Holds its equality of surface after two and three years' use. Repaired and restored easily. Cost assessed, 59 per cent. against abutting property, 41 per cent. against city. (I learn from other than municipal sources that specifications were made to permit either asphalt or brick to be bid for, as there seemed to be a combination between the brick contractors to hold up the price. In the competition asphalt underbid the brick as a result).

Adrian—Uses brick Laid by city past two years, previously by contract. Laid by city at less than contract price, which was about $1.71 per square yard. Brick laid on six inches crushed stone. City paid one-third and abutting property two-thirds of cost. Surface remains even after use.

Ann Arbor—Uses brick on six inches of concrete and asphalt block on gravel. City engineer states that relative superiority of one over the other of these two pavements is a matter of opinion; city expects to lay asphalt block the coming year. Asphalt cost $2.21 per square yard, exclusive of curb and excavation. Brick cost 49 cents per square yard and concrete $3 per cubic yard, or $1.44 per square yard complete. Laid by contract, and the brick holds its evenness of surface after three years' use. Asphalt has been laid less than a year. Success of restoring surface after excavation depends upon care taken. Cost met by issue of bonds, and city pays for street intersections and 20 per cent. to 25 per cent. of the remainder.

Lansing—Uses brick and regards it best for streets with heavy traffic. Cost from $1 to $1.50, exclusive of curb and drainage. Cheapest laid on sand, best on concrete. City engineer volunteers information that Columbus, O., laid brick on broken stone, but always had trouble through formation of cavities by settling of sand cushion, which is laid between the concrete and the brick in all of these pavements, into the broken stone. When proper brick is used, wears well under traffic. First laid there about six years ago, is on concrete and except where there are defective brick retains its evenness of surface. Surface easily restored on concrete foundation, but difficult on less substantial base, owing to subsequent settling, even under exercise of great care, especially in heavy soils. City pays for intersections, and as much more as common council decides, usually about one-third.

Ionia—Uses cedar block, but considers brick best and most practicable. Would not favor cedar block.

Mt. Clemens—Has replaced cedar block with brick, and considers it best. Cost $1.72 to $1.85, using old curb. Laid by contract on six inches of concrete. Holds its surface and easily restored when broken for excavation. Entire cost assessed against abutting property, except street intersections.

Grand Haven—Uses gravel on account of its convenience. Estimates cost at about $1 per square yard. City owns large gravel bed, and transports gravel by barges at low cost.

Manistee—Uses cedar block, and some crushed stone on less used streets. Block practicable for about five years, "then repairs come in fast." Will replace with brick. Twenty-five per cent. paid by city, 75 by property owners.

West Bay City—Uses brick laid by contract, at $1.74 per square yard, including concrete foundation. Laid about three fourths of a mile last summer. One-half the cost assessed against abutting property, and one-fourth by city and one-fourth by ward.

Bay City—Uses brick and cedar block. Considers brick best. Block cost $1.25 per square yard; brick, including foundation, etc., $2 per yard. Brick laid on six inches concrete. Holds its surface well, and can be restored after excavation if care is exercised in tamping sub-grade. Cost met by assessing 70 per cent. against abutting property, 30 per cent. to street fund and alleys to wards. Now lays nothing but brick.

Flint—Uses brick in business portions. Considers brick best. Costs $1.30 to $1.50, exclusive of curbing, mostly laid by contract. Foundation, six inches concrete. Holds its equality of surface, and restored fairly well after excavation if properly done. Cost met by assessing 75 per cent. against abutting property and 25 per cent. by the city, including street intersections. Property-holders pay 1-5 each year for five years, with interest on obligations issued.

Battle Creek—Uses brick and asphalt block. Considers brick best and most practicable, average cost of which was $1.32 per square yard. About 4,000 feet laid by contract, balance by city. Two and one-fourth miles in use, first laid in 1896. Foundation, six inches concrete. Surface remains in good condition, and can be restored after excavation with care exercised. Two-thirds assessed against abutting property, by sale of bonds.

There appears to be no crushed stone or macadam used on the business streets of any city in Michigan, and I therefore corresponded with a few Ohio towns where it has been used. Briefly summarized, the information adduced is as follows:

Van Wert—Paved two streets some years ago with crushed stone, of macadam, drawing the stone from quarries four miles distant, where there is abundance of material. It cost 60 cents per square yard for crushing and about the same for hauling. Cost of grading and rolling not stated. Was not satisfactory on business streets, soon wore in spots, making "chuck holes," was muddy in wet weather and disagreeably dusty in dry. Main street now paved with brick and considered best and most practicable. Their side streets are some of them still paved with macadam, and are satisfactory for light driving. They lay so-called stone roads in that neighborhood, leaving room for "dirt" road on one side. The macadam is used in wet weather, but the dirt road for the most part in dry weather.

Stryker—Side streets paved with macadam, main street with brick on six inches of concrete. The brick, including every-

thing, cost $1.50 per square yard, the macadam, $1.59 per cubic yard, being laid about ten inches deep. Does not recommend the stone for business streets. Their streets are giving perfect satisfaction.

Other Property of Owners of Lots Confiscated for Improvements Liable for Balance Due.

The Indiana Supreme court rendered a decision recently reversing a judgment of the lower court regarding street improvements in Gas City, Ind. In 1894 certain streets in the city were improved under the Barrett law. In many instances the assessment amounted to more than the value of the abutting land. The Gas City land company took advantage of the payment by installments and signed the waiver and agreement in writing provided for in the statute, whereby it promised and agreed that it would make no objection to the assessments on account of illegality or irregularity and that it would pay the assesments, with interest. Default was made in the payments, and the whole amount of the assessments having become due by reason thereof, suit was brought by the Wayne county savings bank, the holder of the bonds, upon the said assessments and the agreements, in order to enforce and foreclose the lien given by the statute, and also for a personal judgment against the lot owner. The lower court held that the assessments were liens upon the lots, and the lots could be sold to satisfy the same, but that there could be no execution against the Gas City Land company for the collection of any balance remaining unpaid after the sale of the lots. The opinion of the Supreme court, written by Chief Justice Darling, was as follows

The statute imposed no personal liability for the cost of the improvement. It did provide, however, for the voluntary execution by the property-owner of an agreement in writing by which, in consideration of an extension of the time of payment and the privilege of making such payment in installments, the property-owner agreed to waive objection to all irregularity and illegality in the proceedings, and to pay the assessments. The Gas City Land company executed such an agreement. It was a simple contract, supported by sufficient consideration, entered into voluntarily and created a personal liability for the payment of the assessments. The lots assessed were primarily liable for the cost of the improvement, and, by reason of its agreement to pay the assessments, the Gas City Land company became responsible for any deficit of such cost, and interest, after the sale of the lots on foreclosure of the lien. The situation of the land company is much the same as if it had executed its promissory note to the contractors for the amount due, waiving all defenses arising from irregularities, payable upon the foreclosure of the lien, and subject to credit for the proceeds of the sale of the lots upon such foreclosure.

The lower court was ordered to render judgment for the sale of the lots and for the collection of any balance by levy upon and sale of any other property of the Gas City Land company subject to execution.

Lot Fronting Two Streets Can Be Assessed for Both Improvements.

A decision was rendered recently by Judge Caswell in the suit of O. H. Wallin vs. the city of Marshalltown, Ia. The plaintiff purchased a lot near the corner of N. First and Center-sts. Both of these streets were paved, the improvements thus abutting two sides of the lot. The plaintiff brought suit to enjoin the sale of the property for the assessments. Smith, Moss & Brown of Chicago, owners of the certificates, intervened. The plaintiff claimed that the city could not place two assessments on the lot and sell it for the two claims, alleging that it would be contrary to the constitution. In his decision Judge Caswell held that Mr. Wallin had purchased the lot prior to the improvements and was conversant with the situation, and that a lot fronting on two streets could be assessed for both permanent improvements.

In the paving case of Leonidas King against the city of Marshalltown, to restain the collection of paving assessments in N. Center-st., the plaintiff has appealed. The lower court decided in favor of the city.

Portland (Ore.) System of Special Assessments Unconstitutional.

A decision was rendered by Judge Bellinger in the United States court at Portland, Or., April 18, who held that the method of making the assessment for street improvements in that city is unconstitutional. The decision of the federal supreme court in the case of Norwood vs. Baker holds that the assessment for an improvement without considering the question of specified benefits is taking his property without due process of law, which is in violation of the fourteenth amendment to the constitution. This ruling overrules the demurrer of the city of Portland to the compalint filed by J. Thorburn Ross to restrain the chief of police from selling the Marquam building to collect an assessment for the improvement of Sixth-st. with asphalt.

Judge Bellinger's decision will practically suspend all new street work until the United States supreme court shall pass upon the constitutionality of the city charter.

Queens County Sprinkling Contract Void After Incorporation in New York City.

An opinion has been handed down by Justice W. G. Gaynor in the suit of Assemblyman Eugene F. Vacheron to recover a claim of $11,662 for sprinkling certain macadamized streets of the borough of Queens,

from Aug. 1 to Nov. 1, 1899. The decision is in favor of New York City. The court held that the contract with the plaintiff had no validity after 1897. The charter was passed May 4, 1897, to go into effect Jan. 1, 1898. The power of the board of supervisors of Queens over the roads of the county was thereby limited to the period from May 4, 1897 to Jan. 1, 1898. The contract in question made July 6, 1897, was, therefore, invalid except for the rest of the year 1897.

The suit was brought for services rendered under a written contract between the plaintiff and the Queens county board of supervisors of July 6, 1897, whereby the plaintiff agreed to sprinkle certain county roads in Queens county for ten years and three months at $20,000 per year, or a total of $205,000. Payments were made by the Queens county board of supervisors for work performed in 1897 under the contract and in 1898 after mandamus proceedings, a total payment of $30,000. In a second mandamus proceding against the board of supervisors of Queens county to compel it to audit and pay plaintiff's bill for 1899, the appellate division denied Vacheron's application, saying that the claim was an obligation against the city of New York and not against the supervisors of Queens county.

Action was then commenced against the city of New York, a decision in which has just been rendered by Justice Gaynor. The plaintiff set up that the appellate division's opinion was based on the theory that the contract was a legal one. The city's defense was that the contract was null and void in the absence of legislative authority for the board of supervisors to enter into a contract for the sprinkling of the county roads, and that it was an attempt to deprive the successors of the board of supervisors of their power over the maintenance of such roads. The city maintained that it was against public policy in that the supervisors of Queens county, in entering upon the contract, did not act for the purposes of Queens county, but really for the purposes of the city of New York, for which they had no power to act. The court said:

I do not see how any distinction can be made in respect to the claim existing at the time the defendant, city of New York, was created against any of the municipal corporations that were made into it. The auditing power is discretionary.

Street Cleaning in Wilmington, Del.

In his annual report for the fiscal year, Harvey J. Wiley, secretary of the street and sewer department, Wilmington, Del., compares the conditions of the streets of that city with those of other cities of the same size and larger. He says the comparison shows that Wilmington has cleaner highways, and at less cost. The city has fifty-four miles of streets and avenues improved, which have been cleaned most effectively by hand brooms and the sweeping machines for general business travel. Owing to the prevalence of good weather the street commissioner found it necessary to keep the street cleaning corps at work for a longer season than has been heretofore practicable, and the cost for the year's cleaning was but a fraction more than $15,000, making an average cost of about $278 per mile of improved streets, or $196 to each 1,000 of the city's population, and one and one-half cents per square yard of improved streets.

The barrow patrol system for cleaning the streets has met with such general satisfaction that persons residing in those sections of the city where the system has not been introduced, have petitioned for such service. Mr. Wiley suggests the adoption of the hand patrol cart holding a nest of cans or vessels, by which means a patrolman will have sufficient vessels to be filled and set along his route to be collected and emptied into a wagon or cart, which will be required to follow and make collections from several districts; this scheme will permit a patrolman to remain at work upon his district at all times. The brick-paved streets in the business sections at least could be most effectively and thoroughly cleansed by flushing such sections at night with water from the fire hydrants.

Electrolysis in Hartford and Brooklyn

The attention of the board of water commissioners at Hartford, Conn., has been called to two cases of electrolysis which occurred during the month of March. In his report regarding this danger to the water pipes E. H. Judd, acting president, says:

As this is a heavy expense to this department on account of opening the improved pavement and paying for repairing same, we shall soon be obliged to resort to some method to see who is responsible for the damages. It does not seem right for this department to pay for opening and relaying improved pavement, when the leaks are caused by electrolysis. It will soon be a question whether this department shall keep on repairing the leaks at our expense or render the bill to the street railway company.

The water department of the borough of Brooklyn has also called the attention of the commissioner of public buildings, lighting and supplies to the electrolysis of underground pipes, with the request that the subject be investigated by that department, under whose jurisdiction it is placed by the charter of Greater New York. James J. Kirwin, deputy commissioner of public buildings, lighting and supplies for Brooklyn, suggests that the consulting engineer of lighting and electricity be requested to outline a plan for investigating

New Whatcom Loses Its Water Supply by Court Decision.

The Washington supreme court has rendered a decision in which a perpetual injunction is granted restraining the city of New Whatcom from using Lake Whatcom as a water supply. The Fairhaven Land company, which operates a mill by power deprived from Lake Whatcom, asked for the injunction. The city expended $183,000 for a water works system, and is now without a supply.

Private Agreement to Shut Off Competition Cannot Be Enforced.

The Illinois supreme court rendered a decision April 18, in which it reversed and remanded the case of the R. F. Conway company against the Garden City paving and post company. The suit resulted from a private understanding between the Garden City paving and post company, the R. F. Conway company and A. J. McBean, who were bidders for the Laughton street paving in Chicago. The companies agreed to make the same bid for the work, then bid among themselves, the two lowest withdrawing and dividing equally the amount bid by the highest. The supreme court declares that it cannot enforce private agreements among rival bidders who enter into agreements to shut off competition. The court decides that the private contract is void for the reason that its object was to prevent competition.

Cincinnati to Appoint an Engineer on Grade Crossing Problem.

The board of legislation of Cincinnati, Ohio, has adopted a resolution authorizing the board of public service to appoint an assistant to its chief engineer, at a compensation of $2,500 per year, whose duty it shall be to devise ways of eliminating dangerous railroad grade crossings.

Another Phase of the Ogden Water Case.

A temporary injunction was granted by Judge Marshall of the United States court, April 9, which prohibited the city of Ogden, Utah, and its city officials from interfering with the cut-offs, valves, hydrants or other property of the Ogden Water Works company. Judge Marshall holds that the city of Ogden had no right whatever to interfere with the officers of the company when they shut off the water from delinquents. The plant did not belong to the city, even though the municipality held a judgment lien on it. The judgment lien gave the municipality no right whatever to dictate how the plant should be operated, or to exercise any control over it.

Judge Marshall did not pass on the resolutions passed March 16 and March 22, in which the citizens were requested to enter into no contracts with the water company and to pay no rates to anybody. He was in doubt as to whether or not he could legally enjoin the council from passing any more such resolutions. He thought the resolutions were called out by the notices sent around by the company telling their patrons to settle their bills and enter into new contracts. Referring to the resolutions of the council, Judge Marshall said:

Now they do not say in those resolutions not to use the water or, in other words, to boycott the company. They only ask the citizens not to pay for the use of the water. That is not right. There seems to be some sort of agreement between the defendants, perhaps not considered as an agreement by them, to prevent the payment to the plaintiff of water rentals due it. There is no justification for any action which prevents the collection of water rentals and still allows the use of the water by those who are delinquent in their payments for it.

Regarding the judgment lien, he said the city seemed to think it had the right to take possession of the water works plant. This was not correct. There were two ways of enforcing such a lien. One was to enter into peaceful possession of the property by agreement of the parties, and the other was to file a petition asking the appointment of a receiver. Neither of these steps had been taken.

Municipal Telephone Systems Authorized in Wisconsin.

The Wisconsin legislature has enacted a bill giving any municipality a right to issue negotiable bonds on the petition of a majority of its freeholders for the establishment and maintenance of a telephone system. The bonds are to draw 5 per cent. interest, and are to be made in twenty years, 5 per cent. being set aside annually for a sinking fund. With the maturity of the bond the plant is to become the unincumbered property of the township.

Judgment of Texas Court of Appeals in Favor of Contractors on San Antonio Sewers.

A decision was rendered in the fourth court of civil appeals, April 3, at San Antonio, Tex., reversing the judgment of the

lower court in the case of Marshall, Backus & Hines vs. City of San Antonio. The following extract is taken from the opinion:

For the appellee to take and appropriate to its use appellant's property or money due them in its hands in the summary manner provided by the original contract it must bring itself strictly within the provisions of the contract. The evidence clearly shows that it has not done this, and in our opinion from the very nature of the contract, it is unable to do so, yet under cover of this provision of the contract it has confessedly taken and appropriated to its own use the sum of $26,641.79, which it admits appellants earned under the original contract. We have searched the record in vain for anything that gives the city a semblance of claim or shadow of right to this money, and have earnestly looked through appellee's brief of 123 pages to find something that would uphold the judgment of the trial court in sustaining this action, but in vain.

Reapportionment of Maintenance Charges of Metropolitan Sewerage District in Massachusetts.

A reapportionment of the amounts which the various cities and towns in the Northern metropolitan district should contribute to the cost and maintenance of the Metropolitan system of sewers, is necessary this year, and in accordance with the law, the Massachusetts supreme court must appoint a commission which will have authority to decide upon the percentage which each city and town should contribute. The law requires that an apportionment shall be made every five years, and the last one was made in 1896. The supreme court appointed a commission in 1891 to determine the proportion which each of the cities and towns should pay for five years to meet the interest and sinking fund requirement of the system each year, and also to meet the cost of maintenance and operation of the system. The court appoints three men on the commission, who are not residents of the cities and towns in the district. The court has ordered the petitioners to give notice to each of the cities and towns to appear before the supreme court May 6.

The Metropolitan sewerage system was built by an act of the legislature in 1889, and the northern district includes a part of Boston, Cambridge, Somerville, Walden, Chelsea, Woburn, Melrose, Medford and Everett, and the towns of Stoneham, Winchester, Arlington, Belmont, Winthrop and Wakefield.

Unconstitutionality of New York Labor Law Affects Brooklyn Bridge Contracts.

Justice McAdam of the New York Supreme court granted an injunction, March 28, restraining John L. Shea, as commissioner of bridges of the city of New York, and his subordinates, from awarding or entering into contract for furnishing all the labor, materials and plant necessary for the construction of the tower foundation of bridge No. 3 over the East river. Judge McAdam also set aside any award or contract which may have been made by Commissioner Shea, pursuant to advertisements issued, and bids received by him on March 11 from contractors. The plaintiff is Simon H. Bergoffen, who sues as a taxpayer, and claims that the lowest bid, which was made by Williams & Gentle, is irregular, and they are not, therefore, entitled to the contract. The irregularity claimed is shown in the fact that the company fixes two prices for each item. An item is cited for example which is as follows: "For completed work between the Datum plane and the horizontal plane 96 ft. below mean high water, $9,000, $18.00 per cu. yd." It is claimed that as the preliminary estimates upon which the contractors bid are only approximate, and may be more or less, the bid of $9,000, if intended for the whole work, might occasion either a loss to the contractor or to the city, according to the amount of work to be done.

The principal claim on which the application is based, however, is that the insertion of a stipulation requiring the contractors to obey the prevailing rate of wages law, or the cut stone or dressed stone law, or the labor law, which have recently been declared unconstitutional, makes the contract invalid.

Coloring Cement.

The qualities required in the colors used to color cements are: The property of thoroughly mixing; that of not decomposing under the action of lime, and that of resistance to the action of light, says La Ceramique. These colors should mix completely with the different compositions of which cements are made up, the cohesion of which they diminish. The means of testing them are to mix them with a certain quantity to a given quantity of slaked lime. Care must be taken not to use low-priced materials containing salts of lime and barytes, which give to the objects which contain them, especially when damp, a veiny aspect, which has a very bad effect. The colors for cements should resist the action of chemical alkaline agents. When washed by soda they should not be impaired after a day of this treatment. Those which mix well are unassailable by

chemical alkaline agents and resist the action of light fairly well. The best means to assure one of these qualities is to color a plane surface and to cover certain parts with some opaque bodies and to expose the painted surface to the sun's rays for some time. The most common red is jeweler's red or brown red, composed essentially of peroxide of iron in the proportion of eighty-five per cent. at least. Red ochre (calcined) is less recommendable. The ochres, composed essentially of peroxide of iron and alumine of lime, constitute the yellows. These diminish very slightly the cohesion of cements. The ochres have also the advantage of being the less expensive yellows. Sienna earth (not burnt) may also rank in this category. Ultramarine is the blue most employed but it is well to correct the reddish reflection it has, especially in artificial light, by adding to it fifty per cent. of sea green. These three primary colors serve to compose the secondary shades—orange color, violet, green, etc.; neverless the lime resisting colors not always permitting certain mixtures, one has recourse to chrome greens, ultamarine and umber.

Water Park Proposed in Back Bay Basin, Boston.

The question of forming a water park in the Back Bay basin at Boston, by damming the Charles river, is being revived. The metropolitan park commission and the Massachusetts State Board of Haelth investigated the subject in 1894, but the project was dropped, owing partly to the opposition to the proposal to form land for another row of houses beyond the present Beacon-st. water front. This feature is omitted in the present plan, which is also different in other particulars. The plan includes a proposal for movable dams or gates in the proposed Charles river dam. The appointment of a state commission, to investigate and report on the subject, is the only action contemplated at present. A large part of the land bordering on the portion of the water front included in the scheme is already reserved for park purposes, either by the Metropolitan park commission or the several municipalities in which it is located.

Technical Meetings.

The twentieth annual meeting of the American Street Railway association will be held in New York City Oct. 9, 10 and 11. T. C. Penington, secy., Chicago.

The annual meeting of the National Electric Light association will be held at Niagara Falls, N. Y., May 21 to 23. Geo. F. Porter, secy., 120 Liberty-st., New York City.

The spring meeting of the American Society of Mechanical Engineers will be held in Milwaukee, Wis., May 28 to 31. F. R. Hutton, secy., W. Thirty-first-st., New York City.

The annual meeting of the Canadian Electrical association will be held in Ottawa, Ont., June 19 to 21. C. H. Mortimer, secy., Confederation Life Bldg., Toronto, Canada.

The Municipal League of Indiana will hold its ninth semi-annual meeting in Columbus, Ind., May 8, 9 and 10. Mayor Z. T. Dungan of Huntington is president and Councillman Alonzo Kibbie of Columbus is secretary of the league.

The National Municipal League will meet in Rochester, New York, May 8, 9 and 10. James C. Carter, New York, president; Clinton Rogers Woodruff, Philadelphia, secretary.

The Society of Engineering and Applied Science is a new society organized at London, Ont., with officers as follows: President, Prof. Bowman; vice-president, F. W. Merchant; secretary, F. W. Farncombe; treasurer, R. Kirkpatrick. The society will follow the lines laid down by the Engineers' club of Toronto.

The American Society of Municipal Improvements will hold its next meeting at Niagara Falls the week beginning Sept. 30.

The eighth session of the Municipal League of Indiana will be held at Columbus, May 8-10. Among the papers to be presented will be the "New Street Improvement Laws," by City Attorney J. T. Merryman of Decatur; "Mayors, Their Duties and Powers," by Mayor M. T. Krueger of Michigan City. The tramp problem, curfew and spitting ordinances, public libraries, cigarettes, terms of office will also receive attention. Z. T. Dungan, Mayor of Huntington, is president.

Mayors Elected.

Mayors have been elected and re-elected as follows:

John N. Hinkle, Columbus, O.; Tom L. Johnson, Cleveland, O.; Samuel L. Jones, re-elected, Toledo, O.; M. L. Milligan, Springfield, O.; John L. Means, Steubenville, O.; C. Milstead, Portsmouth, O.; J. E. Smith, re-elected, Piqua, O.; Harry W. Mountain, Ironton, O.; Dr. J. I. Holden, Zanesville, O.; John J. Molter, Sandusky, O.; William B. Doyle, Akron, O.; Joseph H. Robertson, re-elected, Canton, O.; S. D. Emery, Owosso, Mich.; the Rev. Dr. I. S. Copeland, Ann Arbor, Mich.; J. W. Patch-

in, Traverse City, Mich.; James Shanley, Albion, Mich.; John W. Howell, Marshall, Mich.; G. S. Stanley, Cadillac, Mich.; E. L. Rose, Petoskey, Mich.; W. A. Callen, re-elected, Centerville, Ia.; T. S. Fry, Mobile, Ala.; Henry Beckman, Kankakee, Ill.; Robert Rohl, Centralia, Ill; —— Sawyer, Monmouth, Ill.; Charles Shilling, Decatur, Ill.; Amasa Hutchins, Rockford, Ill.; Lewis B. Thomas, Bloomington, Ill.; A. W. Young, re-elected, Alton, Ill.; —— Davis, Jacksonville, Ill.; R. J. Barr, Joliet, Ill.; George Alschuler, Aurora, Ill.; James A. Patton, Evanston, Ill.; J. R. Oughton, Dwight, Ill.; E. C. Jewett, Woodstock, Ill.; William F. Bryan, Peoria, Ill.; C. H. Wilson, Washington, Ia; John C. B. Briggs, Nevada, Ia.; Mahlon M. Head, Jefferson, Ia.; J. E. Wilson, Perry, Ia.; J. H. Strubel, Toledo, Ia.; S. C. Huber, Tama, Ia.; J. H. Stubenrauch, Pella, Ia.; Frank Long, Newton, Ia.; P. M. Plumb, re-elected, Marion, Ia.; Charles H. Finch, Ft. Madison, Ia.; W. A. Callen, re-elected, Centerville, Ia.; —— Ross, Indianola, Ia.; J. J. Shell, Boone, Ia.; S. A. Steadman, Manchester, Ia.; G. W. Alexander, Chariton, Ia.; W. A. Jackler, Anamosa, Ia.; E. M. Evans, re-elected, Vinton, Ia.; Eugene Shaffter, Eagle Grove, Ia.; W. B. Murray, Fairfield, Ia.; F. K. Stebbins, re-elected, Iowa City, Ia.; Anson Barstow, Oakland, Cal.; W. H. Roe, Kearney, Neb.; F. A. Edwards, Webster City, Minn.; Carter H. Harrison, re-elected, Chicago, Ill.; —— Covert, Evansville, Ind.; —— Reefy, Lorain, O.; —— Fletcher, Chippewa Falls, Wis.

Personal Notes.

E. S. Bryant has been elected city engineer at Berlin, N. H.

F. C. Turner has been appointed city engineer at Oakland, Cal.

Stephen J. Bussell has been appointed city engineer at Oldtown, Me.

Philip H. Coombs has been elected city engineer at Bangor, Me.

Charles W. Campbell has been appointed city engineer at St. Joseph, Mo.

George W. Tonson was elected city engineer at Toledo, O., April 15.

Cyrus T. Long has been re-elected borough engineer at Greensburg, Pa.

John Meehan has been elected street commissioner at Chippewa Falls, Wis.

Samuel Zirkle has been appointed superintendent of waterworks at Luray, Va.

Adna Dobson, city engineer of Lincoln, Neb., has been appointed state engineer.

Lewis F. Prevost, city engineer at Lima, O., died suddenly of heart disease April 12.

L. J. Wagner has resigned his position as superintendent of water works at Rome, N. Y.

Clarke B. Collins of Johnstown, Pa., has been elected borough engineer at New Florence, Pa.

J. N. Hazlehurst of New Orleans, La., has been elected engineer for the proposed street paving in Mobile, Ala.

Charles Wallanger has been elected superintendent of the city water works at Harriman, Tenn., to succeed P. A. Knapp, resigned.

John J. Molter has been elected mayor, A. M. Wagner city clerk and John W. Miller city engineer at Sandusky, O.

Hiram Phillips, M. Am. Soc. C. E., has been elected president of the board of public improvements at St. Louis, Mo.

George C. Wimberly has been re-elected city engineer at El Paso, Tex. Mr. Wimberly has held this office since April, 1894.

Carl Bedell, assistant city engineer at Nebraska City, Neb., has been appointed electrician of the electric light company of that city.

G. L. Jones has been elected president, Dr. Baumhardt vice-president, and Mr. Neilson secretary of the water works board at Lorain, O.

Daniel R. Walker has resigned his position as chief of the electrical bureau at Philadelphia, Pa., after forty-five years of continuous service.

Frank H. Martin has been appointed a member of the water board at Springfield, Mass., to succeed Henry F. Moriarity, whose term expired Jan. 1.

Frank L. Marston, former city engineer of Bangor, Me., has established an office in the Bass building in that city, where he will practice civil engineering.

Charles M. Gray has been elected president, A. N. Russell, secretary, and John V. Schmidt treasurer of the board of water commissioners at Ilion, N. Y.

E. W. Buckley has been elected city engineer, W. F. Reed superintendent of water works, and George Houston water commissioner at Kalamazoo, Mich.

F. W. Dalrymple, Assoc. M. Am. Soc., C. E., has resigned as city engineer at Hornellsville, N. Y., and has been appointed city engineer at Jamestown, N. Y.

Robert Cochran Bacon, formerly chief engineer and superintendent of water works at Jersey City, N. J., died at his home in East Orange April 12, aged eighty-three years.

Lewis M. Hastings has been elected city engineer for the thirteenth time at Cambridge, Mass. George Howland Cox has been appointed park commissioner for three years.

Frank N. Kindolf has severed his connection with the Standard Sewer Pipe company of Rochester, N. Y., to become general manager of the American Sewer Pipe company of Pittsburg.

F. T. Sherman of the Long Island City Refinery works, New York, succeeds G. R. Wilton in the management of the local branch of the Alcatraz Asphalt Paving company at Spokane, Wash.

Thomas Herbert Minshall, electrical engineer of Croydon, England, and Charles H. Merz, consulting engineer of London, are investigating electric light and street railway properties in America.

Rudolph Hering, M. Am. Soc. C. E., and Geo. W. Fuller, Assoc. M. Am. Soc. C. E., have formed a partnership as consulting engineers, and will have offices, after May 1, at 100 William-st., New York City.

W. K. Eldridge has resigned his office as city engineer of Lafayette, Ind., and has become associated with S. H. Brubaker & Co., architects and engineers, Stevenson Bldg., Indianapolis, Ind. G. H. Stevenson has been appointed city engineer of Lafayette.

C. H. Reynolds has been appointed city engineer and W. L. Pray superintendent of water works at Ft. Dodge, Ia.

James Ritchie, chief city engineer at Cleveland, O., has resigned to accept the position of consulting engineer to the grade crossing commission. The position of city engineer has been offered to Walter P. Rice, ex-director of public works, who has taken the matter under consideration.

J. W. Bradley, Assoc. M. Inst. C. E., has been appointed city engineer at Westminster, London. For the last six years Mr. Bradley has been borough engineer of Wolverhampton, was on the staff of the borough engineer of Burnley for six years, and prior to his appointment at Wolverhampton was borough engineer of Nelson.

Michael J. Sampson, formerly auditor of the water assessment bureau at Chicago, was confined in the penitentiary at Joliet, Ill., April 10, on a charge of forgery. The final imprisonment of Sampson ends one of the most remarkable fights for liberty ever made by a convicted man in the Illinois courts. His attorney exhausted every resource of law, with one exception—that of appealing to the United States Supreme court.

Charles M. Darling, formerly of the firm of Byrne & Darling, civil engineers of White Plains, New York., has formed a partnership with his brother, Oscar Darling, C. E. of Babylon, N. Y., and will establish an office about May 1 in Mineola, N. Y., with branch offices in Hicksville and Amityville. The firm name will be Charles M. Darling & Bro., and they will practice consulting work and surveying.

Richard Pennefather Rothwell, editor of the Engineering and Mining Journal and of The Mineral Industry, died at his home in New York City, April 17, of cancer of the stomach, aged sixty-five years. Mr. Rothwell was born in Ingersoll, Ontario, Canada. He graduated from the Rensselaer Polytechnic Institute, at Troy, N. Y., as civil engineer in 1858, and from the Ecole Centrale des Mines, at Paris, as engineer of mines, in 1862. In 1871 he united with Eckley B. Coxe and Martin Coryell in organizing the American Institute of Mining Engineers, of which he was unanimously elected president in 1882. In January, 1874, he became an editor, and afterwards owner of the Engineering and Mining Journal, and has edited the Mineral Industry since its beginning nine years ago.

MACHINERY AND TRADE.

New Automobile Street Sweeper.

The Automobile Street Sweeping Company, 185 Summer-st., Boston, Mass., has developed a new machine, now ready for the market, which cleans gutters, sweeps the street, loads the sweepings and sprinkles ahead of the brooms with condensed steam. There are three floors or decks on which dust receptacles can be stored, including a roof which can be extended to any reasonable extent. The machine may be used independently for sprinkling and sweeping. It is said to show no steam nor dust. Being an automobile there are no horses, and when the loading devices are employed it takes the place of three pairs of horses, drivers and outfits.

The company also makes a gutter sweeper which is very effective. A photograph of one at the head of a row of sweepers is shown in one of the illustrations to an article on Cambridge, Mass., Street Work in this number, and the article contains a short statement of the work the machine is doing.

Analyses of Trinidad Asphalt Manufacturing Company's Product.

The Trinidad Asphalt Manufacturing company of St. Louis, Mo., has received an analysis of their product from Prof. A. W. Dow, engineer commissioner, Washington, D. C., which shows the following: Their D. asphalt paving cement contains 99.10 per cent. of bitumen soluble in carbon bisulphide; 0.45 per cent. organic matter not bitumen, and 0.36 per cent. silica and clay; their G liquid asphalt contains 99.68 per cent. bitumen soluble in carbon bisulphide; 0.12 per cent. organic matter not bitumen and 0.20 per cent. silica and clay. The report also states that none of the samples were appreciably altered by being kept at 300 degrees for six hours in an open vessel, and that the cement is of the right consistency to make a good paving material; that it is adhesive and elastic. The report says: "These samples are superior to any I have ever examined in physical properties, and rank among the better asphalts for paving purposes. A combination of D paving cement and your G liquid asphalt will produce a most splendid article."

The company has recently completed a new refinery at 320 to 324 S. Twenty-first-st., which is equipped with the best and latest appliances. The company does not belong to the trust.

Trade Publications.

The Castalia Portland Cement Company of Pittsburg, Pa., with works at Castalia, O., has just issued an attractive pamphlet descriptive of its Tiger brand of Portland cement and the works at which it is made. Excellent reproductions of photographs show views of the works, the rotary kiln

and powdered coal fuel apparatus, as well as many views of buildings, arches, streets, walks, platforms, etc., in which their cement has been used. The company evidently has nothing to conceal and is proud of its plant, for it says: "We would be glad at any time to have our friends visit our works and would take great pleasure in showing them through what we consider to be the best equipped cement plant in the United States.'

The Trials of Contractors is the title of a little illustrated pamphlet issued by the Brinley-Hardy company of Louisville, Ky., showing the advantages of their road plows, light and heavy, ranging from ninety-two pounds to 450 pounds. The saving in repairs by the use of these plows is the point which the writer emphasizes.

Recent Inventions.

669,512. March 12, 1901. Street Sweeper, Edward S. Day, Worcester, Mass. A sweeper of the rotary-brush, endless-carrier type arranged to be attached to the rear of a wagon so as to discharge the dirt therein.

669,632. March 12, 1901. Garbage Furnace, Frank Gorman, Toledo, O. The garbage is discharge upon a rotary annular grate and means is provided for separating the liquids from the solids and spraying the liquids into the furnace.

669,683, 669,684. March 12, 1901. Street Sweepers, John T. Collins, Hartford, Conn., assignor one-half to W. L. Curtiss, same place. Self-propelling sweepers of the rotary-brush type.

670,074. March 19, 1901. System of Sewer Ventilation and Disinfection. George P. Heilman, Evansville, Ind. Each inlet conduit is provided at its surface end with a normally closed-valved liquid inlet, and a normally open fresh air inlet, and circulation is intermittingly obtained by a suction appliance connected to the main sewer.

670,222. March 19, 1901. Concrete-Mixer. Howard Campbell, Brooklyn, N. Y. A chute provided with peculiar deflecting means for insuring a proper mixture of material which is poured through the chute.

670,478. March 26, 1901. Fireproof Construction. Franklin W. Garrettson, Baltimore, Md. A metallic plate is secured to the plaster-supporting means in contact with the inner portions of the plaster. Concrete is then supported on the plate.

670,570. March 26, 1901. Bridge. Willis F. Walker, Charlestown, W. Va. A roadway or walk for bridges composed of I beams having wider lower flanges and a filling of asphalt or cement between and on top of the beams.

670,707. March 26, 1901. Wall Construction. Willis H. Fisher and Claude Brouse, San Francisco, Cal. Composite slab composed of concrete with a metallic tube embedded therein so as to receive dowels for uniting adjacent slabs.

670,778. March 26, 1901. Construction of Tunnels for Sewers. Ossian Guthrie, Chicago, Ill. The method consists in widening a river or canal at the point of intersection with the proposed sewer; sinking a tube or shell transversely of the river at the widened portion; then filling in the widened portion so as to bury the ends of the tube, and finally tunneling to the ends of the shell.

670,926. April 2, 1901. Street Sweeping Machine, Arthur Cameron, Chicago, Ill., assignor to Frederick C. Austin, same place. A gutter sweeper having a peculiar means for supporting the brush which rotates about a substantially vertical axis.

670,968. April 2, 1901. Road Cleaning Machine, Henry J. Ranger, Christ church, New Zealand. A somewhat complicated machine, utilizing brushes about the size of hand brushes.

671,133. April 2, 1901. Rigid Suspension Bridge, Albert V. H. L. Gisclard, Vincennes, France. A three-hinged suspension truss with the end hinges in the body of the truss and the contour the envelop of the curves of force passing through the three hinges.

671,280. April 2, 1901. Street Sweeper, Joaquin Jene, Buenos Ayres, Argentina. A sweeper of the rotary-brush endless-carrier type, with a low-down receiver and a hoist for raising the receiver and dumping into a wagon.

671,340. April 2, 1901. Combined Fire Wagon and Asphalt Mixture Heater, Robert Hooke, Chattanooga, Tenn. A combined tool heating wagon and reheater for asphalt paving.

671,353. April 2, 1901. Method for treating sewage, Robert H. Reeves, London, England. The method consists in spraying unslaked lime with water under high pressure; mixing the lime water with the sewage to precipitate the solid matter, and then treating the effluent liquid with manganate of soda and sulphuric acid.

671,492. April 9, 1901. Apparatus for purifying water, Hans Reisert, Cologne, Germany. A peculiar arrangement of tanks for treating water with milk of lime.

671,596. April 9, 1901. Fire-proof construction, Abraham H. L. Himmelwright, New York, N. Y., assignor to New Jersey Wire Cloth company, Trenton, N. J. The joists are composed of metallic bars extending from beam to beam and arranged edgewise vertically with a downward bend between the beams, the joists being embedded in concrete.

671,679. April 9, 1901. Fire-proof construction, William Orr, Trenton, N. J., assignor to New Jersey Wire Cloth company. The adjacent edges of the reticulated metal sheets are provided with strengthening bars woven into the sheet, and metal spanners are then clamped about the adjacent strengthening bars.

671,686. April 9, 1901. Means for utilizing space in crowded municipalities, Hyppolyte Bergeron, Longue, Canada. An elevated structure supporting tramways is built in the center of thoroughfares and surrounded by buildings of any desired character.

671,777. April, 1901. Self-locking Fire hose bridge. John E. Ryan, Minneapolis, Minn.

671,923. April 9, 1901. Bridge superstructure, Richard Peterson, Elberfeld, Germany. A central tubular main truss is composed of two horizontal main girders and two vertical main girders having their chords in common, and brackets extending laterally beyond the respective main gird-

ers, with a roadway carried by each of the brackets.

Trade Notes.

ASPHALT.

The purchase of an asphalt repair plant is again recommended by Mayor Cunbe of St. Joseph, Mo., in his annual message to the council.

The Western Construction company has been incorporated at Indianapolis, Ind., by Henry W. Marshall as president, S. T. Murdock, vice-president, and Charles M. Murdock, secretary and treasurer, all of Lafayette, Ind. The new company has organized for the purpose of contracting asphalt and other pavements and municipal contracting generally. Mr. Marshall was formerly president of the Western Payinig and Supply company, and the Messrs. Murdock are connected with the Bermudez Asphalt Paving company. The new company will open an office in Indianapolis in the near future, and will enter into competition for the construction of the local street improvements.

BRICK.

The Graves Shale Brick company, about five miles from Birmingham, Ala., which has been in operation since March 1, contemplates making vitrified brick later on. The plant is owned by Capt. W. H. Graves, with H. S. Matthews as general manager and R. T. Kyle as superintendent.

The Mayfield Vitrified Brick company of Graves county, Ky., has been incorporated and will open general offices in Frankfort; capital stock, $20,000.

The Galesburg Paving Brick company, Galesburg, Ill., has elected officers as follows: President and manager, Jas. Bloomfield, Galesburg; secretary and treasurer, W. C. Terry, Galesburg. It was decided at the annual meeting to improve the works, and new kilns and dryers will be constructed.

The St. Louis Vitrified Brick and Firebrick company, St. Louis, Mo., has been incorporated by F. C. Pauley, W. C. Hanley and John P. McMenamy; capital stock, $75,000.

H. Weil & Bros. have established a plant at Goldsboro, N. C., for the manufacture of vitrified paving brick.

R. E. Causey, Thomaston, Ga., desires catalogues, prices, etc., from manufacturers of brick, tile and sewer pipe machinery.

The Jewettsville Pressed Brick and Paving companay of Buffalo, N. Y., has purchased the plant of Brush & Schmidt, and will manufacture paving and other brick. Wm. C. and Wm. H. Warren, H. and Stephen C. Brush will control and manage the company.

The Hickory Run Brick company, Hickory Run, Pa., has been organized by C. A. Dorney, F. Butz and I. D. and S. N. Weaver, to manufacture brick, tile, sewer pipe, etc.

The Greencastle Brick and Tile company, Greencastle, Ind., has been incorporated by Charles S. Eitleberg, Robert L. Higert, George W. Pence, George Hathaway and James L. Randel.

The Virginia Paving Brick company, Chilhowie, Va., has been incorporated to manufacture brick, by G. E. Price, H. B. Smith, H. B. Thompson, H. L. Flournoy and R. S. Spillman of Charleston, W. Va.

A deposit of shale has been discovered by Fred Roth near St. Joseph, Mo., and a company has been formed to manufacture paving brick, roofing tile and drain tile.

A. E. Lain and D. W. Ballou are interested in a new pressed and virtrified brick plant at Hennessey, Ok. T.

W. H. Miller and S. B. Wright, Martinsburg, W. Va., have formed a partnership under the firm name of Miller & Wright for the purpose of manufacturing dry press and paving blocks, Waynesboro, Pa.

The St. Louis Vitrified and Fire Brick company, St. Louis, Mo., have been incorporated and a plant is being erected at Clayton, near St. Louis, which will be ready for business by June 1.

CEMENT.

The Clifford Lime and Stone company, Cartersville, Ga., contemplates purchasing the equipment of a cement plant of 500 to 600 barrels daily capacity.

The establishment of a new cement plant at Durham, Ont., Canada, is contemplated, according to press reports.

The Krause Cement company, Martin's Creek, Pa., has begun to build its plant, which was burned recently.

The Dexter Portland Cement company, Nazareth, Pa., will increase its bonded indebtedness, May 1, from $60,000 to $200,000, and its capital stock from $300,000 to $625,000. The capacity of the plant will also be increased to 2,000 barrels a day.

The German Portland Cement company, Detroit, Mich., has been incorporated by Milton D. Bryce and John W. Smith of Detroit and H. A. Clapp of Cripple Creek, Col. The company will operate cement works in St. Joseph county, Mich.

The Indiana Portland Cement company, which was organized to erect two Portland cement plants—one at Milltown, Harrison county, and the other at Milford, Kosciusko county—will have its main offices in Indianapolis. V. O. Foulk of Detroit, Mich., is secretary of the company. Edwin T. Allen, one of the directors, stated recently that if present plans are realized work on the buildings for the plants will be commenced within four months. A large tract of land has recently been purchased at Milltown and a plant with a capacity of 3,500 barrels a day is proposed.

F. L. Smidth & Co., New York City, have received a contract for equipping the plant of the Iroquois Portland Cement company, at Caledonia, N. Y., with Davidsen patent tube mills.

The Kinderhook Portland Cement company, recently organized under the laws of West Virginia to manufacture Portland cement in northern Indiana and southern Michigan, will open offices in Indianapolis shortly. The marl lands of the company are located near Kinderhook, Mich., and Fremont, Ind.

HOT WATER HEATING PLANTS.

The proposition to grant a twenty-five year franchise to N. P. Hyatt and others for establishing a heating plant to carry steam and gas to all parts of Webster City, Minn., has been favorably voted. The plant will cost about $50,000.

The Home Heating and Lighting company of Indianapolis has awarded a contract to

Fred C. Smock for constructing the new power plant at Sixteenth and Alabama-sts. The building will be three stories, sixty-four by one hundred feet, and will cost about $8,000. Contracts have been let for most of the materials to be used in the system of heating and lighting to be installed.

The city council of Goshen, Ind., refused a franchise April 22, for a municipal hot water heating plant.

The Chillicothe Hot Water Heating company, Chillicothe, O., has been incorporated by Joseph A. Meyers, W. A. Story, Dr. J. H. Lash, M. Kramer and H. E. Holland. The company has applied for a franchise and will begin the work of putting in the plant as soon as it is granted.

LIGHTING

The Fox River Valley Gas and Electric company has been incorporated to furnish gas, electricity, steam heat and hot water to the residents of Neenah, Menasha, Green Bay and Kaukauna, Wis., together with the towns and villages in Brown, Calumet, Winnebago and Outagamie counties. The central plant will be located at Appleton, Wis. The incorporators are James H. Jenkins, Thomas A. Rockwell and David M. Cameron of Oshkosh.

The Gas Arc Light company of the United States, New York City, has been incorporated by J. W. McCrea, C. G. Macy and F. G. W. Sigrist of New York City.

The Oxygen Light and Fuel company has been incorporated under the laws of Delaware, and the general offices will probably be located in East Liverpool, O. The purpose of the company is to manufacture a gas for fuel and lighting purposes. The capital stock is $5,000,000. Frank B. Felt of Chicago is the promoter of the enterprise.

The Hampton Roads Investment and Improvement company has been incorporated with a capital stock of $75,000 to manufacture gas and electricity for lighting and power, and will establish a little town between Hampton and Newport News, Va.

Newly incorporated companies: Montgomery Light and Water Improvement company, Montgomery, W. Va.; Riverside Power company, Riverside, Cal.; Conneaut Lake Electric Manufacturing company, Conneaut Lake, Pa.; International Electric company, Jersey City, N. J.; Bloomfield Light, Power and Heat company, Bloomfield, Ind.

SEWER PIPE.

The Ogden Sewer Pipe & Clay company, Ogden, Utah, has been incorporated to manufacture drain tile, sewer pipe, water pipe, brick and other clay products. Jas. Harris is president.

MISCELLANEOUS.

The Morava Construction company, Chicago, Ill., has begun the erection of a plant to be devoted to the manufacture of bridges and steel frame work It will cost $15,000.

The Domestic Garbage Burner company was incorporated at Salt Lake City, Utah, March 26, with the following officers: President, John W. Donnellan; vice-president and general manager, H. M. Clay; secretary, H. W. Doscher; treasurer, Frank E. McGurrin. The new method of disposing of house garbage is said to consist of an automatic attachment with a piece of the stovepipe from the kitchen range, which carbonizes the debris, no matter how wet, and makes it ready to be used as fuel.

The Pittsburg (Pa.) Seamless Bottle company have awarded contracts to William B. Scaife & Sons, of that city, to design, manufacture and erect the buildings for their glass factory at Everson, Pa. Among the larger structures are the main factory building, mixing rooms, Lehr building, boiler and engine houses. Steel frame construction is to be used throughout.

The Canada Purifying company, limited, Windsor, Ont., has been incorporated to contract for, construct and operate water treatment sewage purification, garbage, heat, light and power works. The incorporators are J. E. Row, William Revell and John Sale.

A company is being formed for the purpose of uniting all the stone quarries in western New York producing Medina block paving stone. The trust will have a capital of $1,500,000. The new firm will control the output of the Medina block pavement in use in Eastern cities. The western part of Monroe county has about fifteen quarries, Orleans county about forty, which with several in other counties makes a total of about seventy-five. The prime movers in the new combination are John J. Ryan of Medina and Michael Slack, owner of one of the largest quarries in the state. A Mr. Chapman of the firm of Moore & Schley, New York bankers, and E. R. Jones of New York are interested.

William B. Scaife & Sons, Pittsburg, Pa., have received a contract from Spang, Chalfant & Co., for extensive additions to their Etna tube works. A number of large steel buildings covered with corrugated iron will be erected, involving a heavy tonnage of structural material.

The street committee of Columbus, Wis., has been instructed to purchase a stone crusher of the Austin & Western Co.

R. G. Parmley & Bro., Sioux Falls, S. D., have begun the manufacture of cement sidewalks.

A. L. Schultz has been appointed manager of the newly-organized Pittsburg district of the American Bridge company with C. W. Bryan as engineer in charge of constructing and chairman of the board, and Richard Kuehn, jr., M. Am. Soc. C. E., Chief Engineer. This district includes the Keystone branch, Mr. J. W. Walker, M. Am. Soc. C. E., Manager, Mr. J. K. Lyons, M. Am. Soc. C. E., Engineer; New Columbus branch, Mr. W. N. Cleveland, Manager, Mr. J. Braune, Assoc. M. Am. Soc. C. E., Engineer; Pittsburg branch, Mr. J. W. Walker, M. Am. Soc. C. E., Manager, Mr. J. G. Spielman, Assoc. M. Am. Soc. C. E., Engineer; Shiffler branch, Mr. J. W. Walker, Manager; Mr. P. Bryn, Engineer; Youngstown branch, Mr. E. M. Scofield, Assoc. M. Am. Soc. C. E., Manager and Engineer; Wrought Iron Works branch, Mr. John R. Reed, Manager, Mr. R. X. Basford, Engineer. Mr. L. J. Affelder, Jun. Am. Soc. C. E., is Contracting Engineer in Charge of Structural Contracting, and Mr. A. J. List, Assistant Mechanical Engineer.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Madison, Ind.—The Jefferson county council has appropriated $85,000 to purchase the pike roads. The owners of the roads ask $96,000 for them.

Cambridge, Mass.—The superintendent of streets and the committee on roads and bridges of Lowell, Mass., visited this city April 8 to examine the vitrified brick paving and the working of the street department.

Kokomo, Ind.—A suit will be tried in June on street improvement bonds amounting to $10,000, in which 300 citizens will be made defendants. The suits, which are being prepared by Farson, Leach & Co., bankers of Chicago, are brought under a recent supreme court decision, holding that property-owners are liable, even though the value of the land benefited is less than the cost of the improvement.

Buffalo, N. Y.—The residents of Main and Genesee-sts. will bring actions under the recent decision of the court of appeals in the eight-hour law to test the validity of assessment rolls for paving three streets.

CONTEMPLATED WORK.

Webster City, Ia.—A boulevard is proposed.

Shenandoah, Ia.—Street paving is suggested by the press.

Peoria, Ill.—Brick paving is proposed for University place.

Ft. Scott, Ark.—Brick paving is desired for Judson-st.

Wahpeton, N. D.—Dakota-ave. will be paved.

Boise, Idaho—Paving is proposed for a number of streets.

Clarinda, Ia.—Paving is contemplated for the public square.

Iowa City, Ia.—Paving is contemplated for College-st.

Montclair, N. J.—This town voted $16,000 for hard roads.

Findlay, O.—Second-st. will be paved with vitrified brick this summer.

Everett, Mass.—The sum of $25,000 has been appropriated for new brick walks.

Hamilton, O.—Ordinances have been passed for paving S. B-st. and Ross-ave.

Red Oak, Ia.—The question of paving is being considered. Mayor Griffith.

Topsham, Me.—The council has decided to purchase a stone crusher.

Gainesville, Fla.—The residents of this city desire brick paving.

Dexter, Wis.—This town voted to purchase a new stone crusher.

Wells, Minn.—The question of street paving is being revived.

Cambridge, N. Y.—The question of paving Main-st. is being considered.

Willoughby, O.—This town will issue $10,000 street improvement bonds.

New Martinsville, W. Va.—This town voted to issue bonds for street improvements.

Camden, N. J.—The question of paving Mt. Ephraim-ave. with asphalt is being considered.

Beloit, Wis.—The question of paving Broad-st. with brick is being considered.

Iowa City, Ia.—A resolution has been passed to pave College-st. with brick. Mayor Stebbins.

Lima, O.—Brick and block asphalt paving is proposed for W. High-st. C. E. Lynch, cy. clk.

Walpole, Mass.—The council has decided to expend $5,000 on concrete walks this year.

Danville, Ill.—The question of concrete sidewalks is being considered. Mayor Bailey.

Irwin, Pa.—The borough council decided April 4 to pave the principal street this summer.

Albert Lea, Minn.—The council committee has recommended paving with brick or asphalt blocks during 1902.

Houston, Tex.—This city voted to issue $300,000 bonds for street improvements and sewers.

Brookline, Mass.—The question of constructing a new boulevard is being considered.

Versailles, Ind.—The question of constructing macadam roads will be voted on May 3. Robt. R. White, co. audt.

Sharon, Pa.—Paving, sidewalks and sewers are contemplated for Sharpsville-st. Joseph Riddle, pres. com.

Binghamton, N. Y.—Resolutions are pending for paving Eldridge-st. and Prospect-ave. with brick.

Wells, Minn.—The council is urged by the press to consider the question of street paving.

Milwaukee, Wis.—E. Water-st., between Erie and Buffalo-sts., will be paved this year with brick or granite.

Madison, Wis.—The council has ordered Johnson-st., from Warren to Bruce, macadamized and guttered.

Brooklyn, N. Y.—Resolutions have been passed to repave Hatsey, Marion and Chauncey-sts. with asphalt.

Denver, Col.—The extension of the asphalt paving of Colfax-ave., from St. Paul-st. to Colorado boulevard, eight blocks.

Sioux City, Ia.—Resolutions have been passed for paving Third, Jones, Jennings, Virginia, Court and Iowa-sts.

Meriden, Conn.—The council has appropriated $15,000 for the purpose of paving State-st. with asphalt.

Kewanee, Ill.—A petition has been circulated asking for two-course brick paving in S. Tremont-st.

Houston, Tex.—Plans have been submitted for paving Tenth, Dart, Holly and Edwards-sts. Cy. Engr. Miller.

Chelsea, Mass.—The question of appropriating $15,500 for street improvements is being considered.

White Plains, N. Y.—The board of trustees have ordered an issue of $100,000 bonds for macadamizing the village streets.

Ft. Wayne, Ind.—Resolutions have been passed for paving Barr and Jefferson-sts. and Masterson-ave.

Dayton, O.—(Special.)—F. M. Turner, cy. engr., says 6,500 sq. yds. of brick paving on 6-in. concrete is contemplated.

Johnstown, Pa.—Ordinances have been introduced for paving Pine, Horner, Short, Hudson, Union, Lincoln and a number of other streets.

Plainfield, N. J.—The street and sewer committee will ask for an appropriation for $26,000 for street and sewer improvements.

Leadville, Col.—The property-owners in W. Eighth-st. have petitioned for grading and will probably construct sidewalks.

Chippewa Falls, Wis.—Mayor Fletcher

recommends the purchase of a rock crusher and the macadamizing of the streets.

La Crosse, Wis.—The residents of West-ave. are in favor of macadamizing that street from La Crosse to Green Bay. Mayor Anderson.

New Martinsville, W. Va.—Plans and specifications are being prepared for brick paving. W. G. Alexander, cy. engr.

Moline, Ill.—Hearings on petitions for paving will begin early in May. Mayor Wessel is in favor of 25-ft. boulevards for residence streets.

Albia, Ia.—Petitions are being circulated asking that the city council pave S. Main-st., from the public square to the bridge over the C., B. & I.

Louisville, Ky.—The new specifications for asphalt reconstruction provide that the city shall lay concrete ready for the asphalt. Chmn. Grainger.

San Francisco, Cal.—Supervisor Curtis has suggested the issue of $1,000,000 bonds for the purpose of improving the accepted streets of this city.

Charleston, S. C.—About 6,000 sq. yds. of macadam pavement by day labor, and drains to cost about $5,000, are contemplated. J. H. Dingle, cy. surv.

Burlington, Ia.—A resolution has been adopted authorizing the city engineer to advertise for bids for paving Fourth and Washington-sts. Mayor Marquardt.

Glens Falls, N. Y.—City Engineer Slade has been directed to prepare estimates for paving South, Warren, Bay and Glens-sts.

Denver, Col.—The board of public works has asked for an appropriation of $10,000 for paving several triangles with asphalt.

Kearney, Neb.—Ordinances have been passed for constructing brick or cement walks. B. O. Hostetler, mayor; H. J. Hull, cy. clk.

Longport, N. J.—An ordinance has been approved for constructing flag, brick, asphalt, cement or wood sidewalks. R. M. Elliott, mayor.

Davenport, Ia.—A resolution has been passed providing for the paving of Fifth-st., from Perry to Western-ave. Thomas Murray, cy. engr.

Bloomington, Ill.—A petition is being circulated for paving Lee-st., from Front to Empire. Paving is proposed between the city and Normal.

Atlanta, Ga.—Plans have been prepared for grading and paving Whitehall-st. with asphalt. Estimated cost $48,125. R. M. Clayton, cy. engr.

Geneva, N. Y.—The board of public works decided April 18 to pave with tar macadam Lake, Geneva, State, North, Center, William and Toledo-sts.

Chicago, Ill.—An ordinance is being prepared providing for paving Arch-st. with asphalt. Geo. K. Wheelock, cy. engr.

Ware, Mass.—Appropriations for street work this year have been made as follows: Highways, $5,500; paving Main-st., $4,500; sidewalks, $1,500.

Gowanda, N. Y.—The broad of trade has submitted a petition to the village trustees asking them to secure estimates for paving the principal streets.

Topeka, Kas.—Resolutions were adopted April 5 for paving Tyler, Quincy and Monroe and other streets with brick on sand foundation. J. H. Squires, cy. clk.

Warren, Pa.—This town voted April 16 to issue $25,000 bonds for paving and curbing Pennsylvania-ave. E. H. Beshlin, cy. clk.

Portland, Or.—The purchase of a steam road roller, at a cost of $3,500, is recommended by Wm. B. Chase, cy. engr., in his report to the council.

Canton, O.—Bids will be asked about the middle of May for over 2-mis. of vitrified block paving and about the first of June for 2-mis. of graveling, curb and flag walks.

Great Falls, Mont.—A report has been adopted providing for the creation of a special improvement district for boulevarding Second-st., between Sixth and Fifteenth-sts.

Nashville, Tenn.—Appropriations are being considered for the following: Paving public square with brick, $23,500; paving First-st. with granite, $8,000. W. M. Leftwich, cy. engr.

Omaha, Neb.—The board of public works has been instructed to obtain propositions for repairing the asphalt pavements on Sixteenth, Cummings and Douglass-sts.

New York City—A macadam roadway 100 feet wide and one and one-half miles long, to connect Claremont with Audubon park, is proposed. Andrew E. Foye, ch. engr. dept .

Kalamazoo, Mich.—The residents on W. Main and S. Burdick-sts. desire asphalt block paving on three thoroughfares. The need of paving in Portage and Water-sts. is also urged.

Troy, N. Y.—The council contemplates the construction of 3,600 feet of brick paving on Oakwood-ave. and 3,000 feet of block paving on Ferry-st. E. R. Cary, cy. engr.

St. Paul, Minn.—A petition has been submitted to the board of public works asking that Eighth-st., between Wabasha and Broadway, be paved with asphalt blocks.

Topeka, Kas.—A petition will be circulated for paving Buchanan-st., from Twelfth to Fifteenth. City Engineer Wise is of the opinion that about thirty-five blocks of streets will be paved this year.

Seattle, Wash.—(Special)—A. H. Dimock, asst. cy. engr., says that 47,000 sq. yds. of asphalt and 18,000 sq. yds. of brick paving on 4 to 6-in. concrete is contemplated. The time for receiving bids has not been set.

Morgantown, W. Va.—A plan for macadamizing the leading county thoroughfares and streets of this city, at an estimated cost of $150,000, is being considered by the city council.

Athens, Ga.—(Special)—J. W. Barrett, cy. engr., says that 8,500 sq. ydr. of granite and 33,000 sq. yds. of macadam paving is contemplated. The work will be done under the direction of the city engineer.

Deadwood, S. D.—(Special.)—D. A. McPherson says that this city contemplates laying about one mile of brick street paving this season of the best material and most approved construction. Sol Star, mayor.

Meriden, Conn.—Bids will be asked for constructing about 3,500 sq. yds. of asphalt paving on State-st. as soon as the plans are completed; estimated cost, $10,000. W. S. Clark, cy. engr.

Chicago, Ill.—The construction of an asphalt road across the campus of the University of Chicago, from Fifty-seventh to Fifty-ninth-sts., and on Fifty-ninth-st., between Ellis and Lexington-aves., is contemplated.

Frankfort, Ind.—Plans have ben prepared by City Engineer Cheney for paving W. Clinton-st., with brick on concrete foundation. A petition is being circulated asking that S. Jackson-st. be paved with asphalt.

Denver, Col.—Petitions will be submitted to the board of public works asking that several new paving districts be created on Capitol Hill. Macadam will be used in paving these streets.

Elmira, N. Y.—The city engineer has been directed to ask for bids for asphalt paving on Baldwin and W. Water-sts. and Madison-ave.; brick paving on Market and Lake-sts., Medina blocks on Nicks-st., 7,000 ft. Medina curb.

New Haven, Conn.—The committee on streets decided April 10 to recommend alluvial clay vitrified brick pavement for Congress-ave., from George to Oak, and crushed stone paving for Orchard, Vernon, Lamberton Ferry, Baldwin and other streets and avenues.

Troy, N. Y.—A resolution has been favorably reported which provides for vitrified brick or block paving, with 16-in. curb, on Oakwood-ave. A resolution has been adopted for paving Ferry-st. with granite blocks with a 20-in. curb.

Orange, N. J.—Ordinances have been prepared providing for the macadamizing and guttering of Snyder-st. Petitions have been referred to the street committee for macadamizing and curbing Essex-ave. and flagging Tremont-ave.

Bowling Green, O.—Plans and specifications for the improvement of Main and Wooster-sts. have been prepared by the city engineer. The work will include 11,633 sq. yds. of paving on new foundation, 54,368-sq. yds. resurfacing, curbing, etc.

Portsmouth, N. H.—A. F. Howard of this city, Wm. H. C. Follansbey of Exeter and Warren Brown of Hampton Falls have been appointed a committee to take charge of the work of continuing the construction of the Ocean highway along the seacoast.

Cedar Rapids, Ia.—The city council has decided to pave as follows: Asphalt—Fourth, Sixth, S. Second, Eighth, Tenth and Twelfth-sts. and Eastlake-place. Brick—First and Second-aves. and an alley. Macadam—Sixth and Thirteenth-sts. and Sixteenth-ave.

Springfield, Mass.—(Special.)—Chas. M. Slocum, cy. engr., says appropriations have been recommended as follows: $53,000 for paving, $53,000 for macadamizing and gravelling, $50,000 for general maintenance and repair. The city may purchase a road roller.

Terre Haute, Ind.—The city engineer's plans and specifications for improving Fourteenth and a Half street, from Chestnut to Sycamore, have been approved and bids will be asked soon. A petition has been filed for building concrete sidewalks and stone curbing on N. Eighth-st., from Wabash-ave. to the Vandalia railroad.

East St. Louis, Ill.—Petitions have been presented to the city council asking that Main-st., between Broadway-st. and Missouri-ave., be paved with asphalt and that Rock road, from Tenth to the Belt railway, a distance of one mile, be paved with asphalt, with 6-ft. granitoid walks on each side of the road.

Minneapolis, Minn.—The council paving committee has ordered paving as follows: Sixth-st., brick; Eighth-st., cedar blocks on concrete, with brick gutters; Washington-ave., N., from Twentieth to Twenty-fourth, sandstone, and from Twenty-fourth to Twenty-sixth, granite; Seventh-st., S. E. State, macadam; Tenth-st., brick; Marshall-st., N. E., limestone macadam.

Cincinnati, O.—Plans and specifications will be prepared for paving Logan and Elder-sts. with brick; Findlay-st. with granite and Green-st. with asphalt. These improvements are to be made under the act authorizing the issue of $100,000 in bonds for street improvements with brick, granite or asphalt. Plans and specifications were ordered for paving Campbell-st. with brick under the general improvement laws.

Indianapolis, Ind.—Ordinances have been passed for paving as follows: Asphalt, West-st., from North to Fourteenth-st; Cora-st., from Illinois-st. to Capitol-ave. Gravel, portions of Dorman, New York, St. Clair, Nevada, Linden, Palmer and Rural-sts. and Temple and Parkway-aves. Creosoted wood blocks, New York-st., from Noble to C., C., C. & St. L. railroad tracks. Cement walks, portions of Spruce, Belmont, Dorman, Twenty-third, Twenty-fifth, Meridian, Sixteenth, Tenth, Dearborn, Illinois, Lambert, Nelson and Thirteenth-sts., and Senate, Arsenal and Capitol-aves. Petitions have been filed for asphalt paving in Kentucky-ave., from Merrill-st. to White river; Louisiana-st., from Illinois to Capitol-ave.; Union-st., from Merrill to McCarty. Block paving and curbing on Tenth-st., from West-st. to the Canal. The city contemplates experimenting with novaculite for repairing Sixteenth-st., from Alabama-st., east. If the material proves satisfactory it will be used in paving other streets. A new 4-inch surface will be put on Sixteenth-st. Albert Sahm, chairman B. P. W.

CONTRACTS TO BE LET.

Washington, N. J.—Bids are asked until May 4 for constructing a macadam road. A. W. Cutler, dir. bd. chosen freeholders.

Gloversville, N. Y.—Sealed bids are asked until May 6 for 3,800 sq. yds. of asphalt block paving. C. Fiske, jr., cy. engr.

St. Paul, Minn.—Bids are asked until May 6 for grading Lexington-ave. Matt Jensen, cy. clk.

Cincinnati, O.—Sealed bids are asked until May 4 for improving Sheed road, from Hanley road to Blue Rock pike. E. L. Lewis, co. audt.

St. Mary's, O.—Sealed bids are asked until May 4 for 7,000 sq. yds. of brick paving. J. H. Rowe, jr., vil. clk.

Greensburg, Pa.—Bids are asked until May 6 for 2,523 ft. of brick paving on W. Pittsburg-st. John S. Bell, burgess; I. C. Snyder, clerk.

Hackettstown, N. J.—Bids are asked until May 4 for constructing a country road. A. W. Cutter, dir. bd. freeholders.

Decatur, Ind.—Bids are asked until May 22 for constructing macadam roads. Abe Boch, co. audt.

Cincinnati, O.—Sealed bids are asked until May 9 for paving McCullough-st., from Eastern-ave. to Dumont-st., with brick. Robt. Allison, prest. B. P. S.

Springfield, O.—Sealed bids are asked until May 3 for about 16,000 sq. yds. of brick or block paving on Clifton-st. Wm. Sharon, cy. engr.; R. N. Lantz, cy. clk.

Paterson, N. J.—Sealed bids are asked until May 3 for paving Main, Market, Marshall and Washington-sts. with asphalt. John T. Brett, st. commr.; H. J. Harder, cy. engr.

Devil's Lake, N. D.—Sealed bids are asked until May 6 for constructing a grade at Pelican Point. Wm. H. Brown, mayor.

Elizabeth, N. J.—Sealed bids are asked until May 7 for grading a street requiring 29,200 cu. yds. of earth excavation, and 1,600 lin. ft. of curb reset. J. L. Barth, cy. engr.

New York City—Sealed bids are asked until May 2 for regulating and grading portions of Bronx and Pelham parkways. Dept. Parks.

Washington, D. C.—Bids are asked until May 4 for about 100,000 cu. yds. of grading on certain streets and avenues. H. B. F. MacFarland, chm. dist. comrs.

Windsor, Ont., Canada.—Bids are asked until May 3 for 60,000 sq. ft. of concrete walks. Stephen Lusted, cy. clk.

Spartanburg, S. C.—Sealed bids are asked until May 4 for 15,000 sq. yds. of granite block and 13,000 sq. yds. of brick paving. F. H. Knox, cy. engr.

Bloomington, Ind.—Sealed bids are asked until May 7 for constructing gravel roads in Ellettsville and Modesto, Gosport and Mt. Tabor. Samuel M. Kerr, co. audt.

VanWert, O.—Sealed bids are asked until May 6 for constructing about 6 mls. of gravel or stone road in Dustman road district, Pleasant twp. C. F. Manship, clk. Pleasant twp., Van Wert.

Columbia City, Ind.—Sealed bids are asked until May 7 for 20,105 sq. yds. of brick paving on Van Buren-st., 13,685 sq. yds. on Line-st., 11,713 sq. yds. on Chauncey-st. Benj. T. Menaugh, mayor; A. N. Miller, cy. engr.

Toledo, O.—Sealed bids are asked until May 13 for paving South-st., from Dix to Summer, with vitrified brick or block, Kreodone creosoted blocks or asphalt blocks. J. E. Connell, cy. clk.

Bessemer, Ala.—Sealed bids are asked until May 7 for grading, curbing and sidewalks on a number of streets, requiring 17,000 ft. of 5-in. granite curb, 2,000 cu. yds. earth excavation, and 3,000 cu. yds. chert. E. L. Mitchell, cy. clk.

Millvale, Pa.—Sealed bids are asked until May 7 for paving, grading and sewering Evergreen-ave., from North to Findlay-st., with vitrified brick. Edw. B. W. P. Fischner, burgess; C. W. Dankmeyer, clk.

St. Louis, Mo.—Sealed bids are asked until May 10 for reconstructing 12 streets with brick on concrete base, and four streets with granite block on concrete base. Robt. E. McMath, pres. B. P. I.

Chicago, Ill.—Bids are asked until May 10 for constructing roads and paths in the post cemetery at Ft. Sheridan. Col. E. B. Atwood, Ch. I. M.

Newark, N. J.—Sealed bids are asked until May 7 for 47,000 sq. yds. of brick and asphalt paving and 12,254 sq. yds. of granite block paving. Ernst Adam, cy. engr.

Seattle, Wash.—Sealed bids are asked until May 18 for constructing 47,200 sq. yds. of asphalt paving, 8,600 sq. yds. of brick gutters and 30,500 ft. of concrete curb. R. H. Thomson, cy. engr.

Akron, O.—Sealed bids are asked until May 4 for furnishing paving cement for brick pavement for the year ending April 1, 1901. Wm. A. Durand, clk. bo. cy. com's.

Havana, Cuba—Sealed bids are being asked until May 29 (postponed from April 3) for street paving. Lieut. W. J. Barden, corps of engrs., U. S. A., chief engineer, city of Havana; Alejandro Rodrigues, mayor.

Michigan City, Ind.—Sealed bids are asked until May 13 for 44,000 sq. yds. of brick paving, 340 ft. of 12 in. sewer and 30 sq. yds. of cement sidewalk approaches. H. M. Miles, cy. engr.

Pottsville, Pa.—Sealed bids are asked until May 7 for curbing, guttering and sidewalks during the coming year and for furnishing broken stone. G. A. Berner, town clk.

Rockville, Ind.—Sealed bids will be received until May 4 on six new sections of levee, according to plans and specifications of John T. Campbell, C. E., on file with him. The work includes 7 mls. of grading. Bids received on sections or as a whole. Lyford Pike and Levee assoc. of Parke Co., John T. Campbell, C. E.

Crawfordsville, Ind.—Sealed bids will be received until May 6 for 177 ft. of grading and graveling in an alley. Sealed bids are asked until May 20 for 295 ft. of vitrified brick paving on concrete on Main-st.; grading and graveling Burford-st. and an alley. Constructing cement walks on Water, Main, E. Main, Market and Washington-st. E. S. Simpson, cy. engr.

CONTRACTS AWARDED.

Kenton, O.—The contract for paving was awarded to C. B. Hall & Co. of Findlay, O., for $14,000.

Spokane, Wash.—The Alcatraz Paving company secured the contract for paving Washington-st. for $23,545.

Findlay, O.—C. B. Hall & Son submitted the lowest bid April 20 for paving N. Cory-st. with brick.

San Rafael, Cal.—The contract for macadamizing Tiburon boulevard has been awarded to E. Schwiesan for $5,495.

New Albany, Ind.—The Barber Asphalt Paving company was awarded the contract for paving Pearl-st., from Spring to Oak.

East Pittsburg, Pa.—Contract for paving and sewering this town was awarded April 15 to Cronan & O'Hara for $48,000.

Lynchburg, Va.—The contract for paving Madison-st. with vitrified brick was awarded to Dean & Payne at $1.29 a sq. yd.

Lima, O.—Spyker, Milligan & O'Brien submitted the lowest bid for paving E. McKibben-st. with asphalt, at $23,763.

Glenville, O.—The contract for paving Doan-st. with asphalt was awarded April 17 to the Trinidad Asphalt Paving company of Cleveland.

Grand Rapids, Mich.—The contract for paving N. Iowa alley with brick has been awarded to Hauser, Owen & Ames for $1,,949.

Franklin, La.—E. A. Grasser of New Orleans was awarded the contract, April 3, for paving the streets of this city, for $15,247.50.

Rochester, N. Y.—The contract for paving Portland-ave. with trap rock has been awarded to H. N. Cowles, of this city, for $52,614.

Camden, N. J.—The contract for building

a macadam road, from Haddinsfield to Greenland, has been awarded to J. F. Shanley of Newark for $14,000.

Trenton, N. J.—A contract for 15,000 sq. yds. of asphalt paving in this city has been awarded to the Interstate Paving company of Utica, N. Y.

Des Moines, Ia.—Magden & Sheley secured the contract, April 12, for 4,331 sq. yds. of brick paving on broken stone foundation, at $1.4616 a sq. yd.

Canton, O.—(Special)—The contract for paving Mulberry-st. was awarded to Wm. S. Hadley, for $3,750, and for W. Fourth-st. to Wise & McCafferty for $4,373.

Bristol, Tenn.—The Virginia Paving Brick company was awarded the contract April 5 for paving Main-st., with brick, at $1.56 a sq. yd., and for the back streets at $1.35.

Worcester, Mass.—The Webb Granite and Construction company secured the contract for furnishing this city with granite curbing, paving blocks, etc., during the ensuing year for $30,000.

Rome, N. Y.—Asphalt paving contracts have been awarded as follows: N. Washington-st., Warner-Quinlan Asphalt company, of Syracuse, $24,013.60; N. George-st., International Paving company, $30,920.04.

Seattle, Wash.—(Special)—A. H. Dimock, asst. cy. engr., says the contract for improving Yesler, May and other streets, involving 24,000 sq. yds., was awarded to F. McLellan for $107,102.

Newton, Ia.—The contract for brick paving was awarded, April 8, to J. H. Killman of Des Moines, as follows: Excavating, 30 cents a cu. yd.; overhaul, 2 cents; paving, $1.53 a sq. yd.; curbing, $34.62 a lin. ft.

St. Joseph, Mo.—The Barber Asphalt Paving company was awarded a contract, April 11, for repairing Sixth-st., from Patee to Olive, at $1.85 a sq. yd. The street is to be paved under the Haynes law, and over the protest of the property-owners.

Louisville, Ky.—Bids were received April 19 for asphalt reconstruction, the prices ranging from $1.85 to $2.25 a square yard. The bids were submitted by R. D. Park & Co., Logan County Asphalt company, Barber Asphalt Paving company, Green River Asphalt company.

Erie, Pa.—Bids were received April 15 for repairing and keeping in repair certain asphalt pavements for a period of ten years, as follows: Cleveland Trinidad Paving company., Cleveland, O., $5,775 per year; Inter State Paving company, Utica, N. Y., $5,980; Warren Scharf Asphalt Paving company, New York City, $5,845; Henry Mayer, Sr., Erie, Pa., $6,100; Mayer Bros., Erie, Pa., $5,046. (This proposition does not comply with the provisions of the ordinance authorizing the work.) The contract implies the resurfacing of the entire 42,052 sq. yds. within the next ten years.

Philadelphia, Pa.—Paving contracts were awarded April 11 as follows: Repairing with asphalt—Pennsylvania Asphalt company, 40 streets, $2.59 to $2.64 a sq. yd.; Richardson & Ross, 40 streets, $2.60; Vulcanite Paving company, 66 streets, $2.57 to $2.64. Asphalt paving—Alcatraz Paving company, 60 streets, $2.38; Pennsylvania Asphalt company, 12 streets at $2.37 to $2.41, and 12 streets at $2.52 to $2.56; Richardson & Ross, 7 streets, $2.37 to $2.41, and 4 streets, $2.50; Vulcanite Paving company, 25 streets, $2.35 to $2.68, and 16 streets, $2.56 to $2.61. Vitrified brick or block—T. Cunningham, 13 streets, $1.90 to $2.35; David McMahon, 3 streets, $2.07 to $2.09; D. J. McNichol, $1.97 to $2.07. Repaving with vitrified brick or block—T. Cunningham, 22 streets, $2.01 to $2.64; D. J. McNichol, 3 streets, $2.03 to $2.07; David McMahon 1 street, $2.10. Repaving with granite blocks—T. Cunningham, 2 streets, $3.02 and $3.05; D. J. McNichol, 13 streets, $2.54 to $2.57. Paving B St. with granite blocks—D. J. McNichol, $2.54. This work will involve nearly $1,000,000. Warner & Quinlan submitted bids for new paving and resurfacing with asphalt, but Director Haddock could not consider them because the company failed to comply with the specifications in furnishing the necessary samples to the highway bureau.

Baltimore, Md.—The contract for paving College and Maryland-aves. and Prince George and King George-sts. with vitrified brick and a number of smaller streets with rubble and cobblestones was awarded April 11 to Geo. and Jos. Jewell for $38,000.

Spokane, Wash.—Bids were received April 8 for paving Washington-st. with asphalt as follows: City Street Improvement company, San Francisco, Cal., paving, $24,203; maintenance, $2,300; Alcatraz Asphalt company, Los Angeles, Cal., paving, $23,945; maintenance, $2,300.

Columbus, O.—The contract for paving Indiana-ave., between Fourteenth and Fifteenth-sts., with Nelsonville brick with cement filler was awarded April 15 to N. B. Abbot for $2,450.50. A. G. Pugh secured the contract for setting the curb on Syracuse-st., from Lathrop-st. to Parsons-ave., for $886.70.

Seattle, Wash.—The contract for cement walks on Seventeenth-ave. was awarded to T. Ryan & Co. for $15,641. The Moore Investment company awarded a contract April 6 to Stanley & Son for opening two mls. of streets in the Capitol Hill tract involving the removal of 60,000 cu. yds. of earth, for from $12,000 to $15,000.

Bay City, Mich.—Bids were submitted April 10 for paving Midland-st., from Center to Euclid-ave. The Ayres Asphalt Paving company of Zanesville, O., submitted the lowest bid on asphalt, $1.191 a sq. yd., including 6-in. concrete, and Campbell & Osborn were the lowest bidders on paving brick, at $1.64, including 6-in. concrete base. The bids were referred.

St. Joseph, Mo.—The contract for grading and macadamizing Fourth-st., from Cedar to Hayes's addition, was awarded April 5 to Helsley Bros. as follows: Macadamizing, $7.25 per 100 superficial ft.; brick gutters, $1.35 a sq. yd.; cross guttering, $1.25 a sq. yd.; cross walks, $1.25 a lin. ft.; sidewalks, 75 cents a sq. yd.; curbing, 45 cents a ft.; grading, 19 cents a cu. yd.

Minneapolis, Minn.—The Galesburg Paving Brick company, Galesburg, Ill., was awarded the contract for furnishing this city with paving brick at 91 cents a sq. yd., and $1.20 for special sizes. Other contracts for furnishing supplies were awarded as follows: A. F. Thompson, crushed slate, $3.15 cu. yd.; Minnesota Sandstone company, sandstone curb, 44, 46 and 49 cents, according to size required; Menominee Pressed Brick

company, Portland cement, $1.89 per bbl., and natural cement, 83 cents per bbl.; Arnold Granite company of St. Cloud, rough granite paving blocks, $1.44½, and dressed blocks, $1.69 a sq. yd.

Chicago, Ill.—(Special)—The R. F. Conway company, Chamber of Commerce bldg., Chicago, was awarded the contract April 16 for repairing asphalt streets in this city for the period ending Dec. 31, 1901, at $1.42 a sq. yd. for wearing surface only and $2.12 a sq. yd. for wearing surface including concrete. The Barber Asphalt company of New York City bid $1.49 and $2.89, respectively.

Erie, Pa.—Bids were received April 15 for resurfacing asphalt pavements on portions of Eleventh, Eighth, Twelfth, Sassafras and Fifth-sts., including ten-year repair contract, as follows: Trinidad Paving company, Cleveland, O., $5,775 per year; Interstate Paving company, Utica, N. Y., $5,980; Warren-Scharf Asphalt Paving company, New York City, $5,845.27; Henry Mayer, sr., Erie, $6,100. Action was deferred. Bids were also received for paving Peach-st., from Twenty-sixth to the southern city limits, with brick, as follows:

Geo. H. Kraft—Park wire cut No. 1, $1.69½ cents per square yard; Mack wire cut No. 1 paver, $1.80; Porter wire cut No. 1 paver, $1.75.

V. D. Eichenlaub—No. 1 wire cut brick, $1.82; Mack wire cut No. 1, $2; Porter wire cut No. 1, $1.90; Advance wire cut No. 1, $1.88.

John McCormick & Son—Park wire cut fire clay, Mack wire cut fire clay, Porter wire cut, Advance wire cut, Canton shale, $1.92 per square yard each.

Mayer Bros.—Jamestown shale No. 1, $1.79 a square yard; Park No. 1, $1.85; Advance No. 1, $1.85; Canton iron block, repressed, $1.85; Canton No. 1 wire cut block, $1.83.

Wilkesbarre, Pa.—The contract for paving St. Clements-st., with brick, has been awarded to Gibbons & Co. of this city, at $1.96 a sq. yd. for Mack repressed block.

St. Paul, Minn.—The R. F. Conway company of Chicago was awarded the contract for paving Rice-st., as follows: From College-ave. to University-ave., $22,285 for city's portion, 10,516 sq. yds., and $5,647 for railroad portion, 2,567 sq. yds.; total, $27,932. From University-ave. to Como-ave., $6,689 for city's portion, 2,958 sq. yds., and $5,581 for railroad portion, 2,537 sq. yds.; total, $12,270. The total bids of the Barber Asphalt company on these sections was $33,581.84 and $14,114.21 respectively. Bids were received March 28 for paving Rice-st., from Como-ave. to Front-st., as follows: Barber Asphalt Paving company, $40,864.40; R. F. Conway company, $46,151. This work includes the following: Asphalt paving, 16,345 sq. yds.; brick paving, 1,320 sq. yds.; curb stone, 7,155 lin. ft.; excavating, 3,193 cu. yds.

SEWERS.

Oberlin, O.—The annual report of W. B. Gerrish, city engineer, states than $380 was required for operating expenses for the sewage farm during 1900. The farm cost $2,490, and is now receiving about 80,000 gals. of sewage daily.

The New Jersey State Sewerage Commission on April 2 considered plans for making surveys and securing estimates of the cost of each of the systems of sewage disposal which might be adopted by the municipalities in the Passaic valley.

CONTEMPLATED WORK.

Hampton, Ia.—A sewerage system is proposed.

Madison, Mo.—A sewerage system is contemplated.

Pendleton, Ore.—A sewerage system is proposed.

Brownwood, Tex.—A sewerage system is proposed.

Oskaloosa, Ia.—A better system of sewage is urged.

New Florence, Pa.—A sewerage system is contemplated.

Jackson, La.—The storm sewerage system is inadequate.

South Haven, Mich.—A sewer in district No. 3 is proposed.

Boone, Ia.—A sewage system is proposed for the Fifth ward.

Hammond, Ind.—A sewer is proposed for May-st. Mayor Reilley.

Oakcliff, Tex.—A company is being organized to build a sewerage system.

Monroe, La.—Bids will be asked soon for building a sewerage system.

Sherman, Tex.—This city voted to issue $80,000 bonds for a sewerage system.

South Brooklyn, O.—This town voted to issue $30,000 bonds for building sewers.

Newton, Mass.—The board of aldermen have decided to issue $20,000 bonds for new sewers.

Oskosh, Wis.—A trunk sewer is urged for Murdock and Jackson-sts.

Sharon, Pa.—The question of building a sewerage system is being agitated.

Toronto, Ont.—The construction of a storm overflow sewer on Wallace-ave. is urged.

Mt. Carmel, Pa.—The question of issuing bonds for a sewerage system is being considered.

Delaware, O.—A resolution has been passed to contract a sewerage system at a cost of $72,714.

Pittsfield, Mass.—Bids for building the proposed sewage disposal plant will be asked soon.

Rockwell, Ia.—The town council is considering the question of building a sewerage system.

Woodbury, N. J.—Plans for a swerage system, to cost $55,000, will be made by Geo. Pfeiffer, of Camden.

Covington, Ind.—Plans for sewers are being prepared by Chas. Cottingham, C. E., of Danville, Ill.

Chico, Cal.—The question of issuing $40,000 bonds for a sewerage system will be voted on in May.

Dayton, O.—(Special).—F. M. Turner, cy. engr., says 36 miles of sanitary sewers are contemplated.

Bangor, Me.—Surveys and estimates for a trunk sewer for the Bakerville district have been proposed.

Washington, Pa.—The borough of East Washington voted to issue $20,000 bonds for a sewerage system.

Eureka, Cal.—Plans and estimates for a sewerage system have been adopted; estimated cost, $85,000.

Florence, Ala.—About $5,000 will be ex-

pended for a storm water sewer at the west end of Tennessee-st.

Winona, Minn.—Plans for a storm water sewerage system have been prepared by City Engineer Miller.

Moorestown, Pa.—A petition is being circulated providing for the issue of $30,000 bonds for a sewerage system.

Bayfield, Wis.—The town board will borrow $5,000 for the purpose of repairing and extending the sewerage system.

Jackson, O.—Plans for a sewerage system and purifying works have been approved by the state board of health.

Seattle, Wash.—(Special)—A. H. Dimock, asst. cy. engr., says about 2-mis. of lateral sewers are contemplated.

Sandusky, O.—The plans for a sewerage system for this city have been approved by the state board of health.

Hartford, Conn.—City Engineer Bond has been directed to prepare a plan for a sewer in Blue Hills-ave. and Harrison-st.

Bozeman, Mont.—The council has approved the plans of S. H. Crooks, C. E. of Livingston, Mont., for a new sewerage system.

Shelton, Conn.—The borough engineer has been instructed to prepare plans for a system of sewers for the South End.

Merced, Cal.—The city contemplates building about 12-mis. of 6 to 12-in. pipe sewers. H. H. Henderson, cy. engr.

Sumpter, Ore.—Surveys are being made preparatory to constructing a sewerage system in the business portion of town.

Bennington Center, Vt.—Surveys for the proposed sewerage system will be made by Garnett D. Baltimore of Troy, N. Y.

Meadville, Pa.—Plans have been prepared for 2,200-ft. of 24 to 10-in. pipe sewers on State-st. W. A. Doane, cy. engr.

New Decatur, Ala.—Surveys are being made preparatory to making plans for the proposed sewerage system. M. A. McCalla, cy. engr.

Binghamton, N. Y.—(Special.)—Henry Ward says that bids are being asked for a sewer in Griswold-st., 3,000 ft. long, to cost about $12,000.

Charlevoix, Mich.—Plans for about 2,775 ft. of 6 to 15-in. sewer in Main-st. have been contemplated. J. M. Eaton, chmn. sewer com.

Troy, N. Y.—The construction of 3,000 ft. of 30x45-in. brick sewer in Ferry-st. is contemplated. E. R. Cary, cy, engr.

Utica, N. Y.—The city engineer has been directed to prepare plans and specifications for a trunk sewer through Water and other streets.

San Francisco, Cal.—The board of public works has asked for an appropriation of $221,000 for building new sewers. C. E. Grunsky, cy. eng.

Lebanon, Ind.—Plans and specifications for a sewerage system for this city are being made by C. G. H. Goss of Martinsville, Ind.

Wauwatosa, Wis.—The common council decided, April 10, to build 4 mis. of sewers and a sewage disposal plant at a total cost of $35,000.

Worcester, Mass.—The construction of the east main carrier of the intercepting sewer system has been decided upon; estimated cost, $79,129.

Uniontown, Pa.—The borough engineer has been authorized to prepare plans and specifications for sewers at Berkley and E. Main-sts.

Terrell, Tex.—The formation of a company to build a sewerage system in this city is contemplated by M. C. Kelly of Gainesville.

Vincennes, Ind.—Plans and specifications for a complete sewerage system for this city have been prepared by Charles C. Brown, C. E. of Indianapolis.

Westfield, Mass.—A special committee has been appointed to investigate the question of issuing $60,000 bonds for building sewers in the southern part of town.

Janesville, Wis.—(Special)—C. V. Kerch, cy. engr., says the question of constructing a general sewerage system was carried by a large majority April 2.

Petaluma, Cal.—(Special)—The board of trustees passed a resolution to construct 1,350 ft. of 12 in. and 300 ft. of 6 in. sewer in B-st. N. S. Frost, cy. engr.

Sault Ste. Marie, Mich.—Plans for a sewerage system will be prepared by Willis Chipman of Toronto, Ont. The question of building the system will be voted on in May.

Holyoke, Mass.—(Special)—James L. Tighe, cy, engr., says that about 3,000 ft. of main sewers are contemplated, although there is no appropriation for the work as yet.

Findlay, O.—Contracts will probably be awarded in July for building a brick sewer in Liberty-st., and a pipe sewer in Elm and Sandusky-sts. John W. S. Riegle, cy. engr.

Athens, Ga.—(Special)—J. W. Barnett, cy. engr., says that sewer extensions, to cost about $30,000, are contemplated. The work will be done under the direction of the city engineer.

Canton, O.—(Special)—A sewerage system, including 8 mis. of sanitary sewers, is contemplated for district No. 1. Bids will be asked by June 1 for over 3 mis. of sanitary sewers.

Washington, D. C.—The district commissioners have ordered the construction of a sewer on a portion of Connecticut-ave. at a cost of $11,382, and a sewer through Waggaman tract at a cost of $5,445.

Minneapolis, Minn.—The committee on sewers will recommend the construction of the remaining section of the east main carrier of the separating sewage system, and for sewers in a large number of streets.

Springfield, Mass.—(Special)—Charles M. Slocum, cy. engr., says the sewer committee contemplates the expenditure of about $65,000 for trunk sewers and about $40,000 for lateral sewers and ordinary repairs. Most of this work will be done by day labor.

Fond du Lac, Wis.—(Special)—Bids will soon be received for intercepting sewers, a sewage pumping station of about 5,000,000 gallons daily capacity, septic tanks and bacterial contact beds. The sewage pumps will be driven by electric power. The disposal plant will have a capacity of 750,000 to 1,000,000 gallons daily. F. B. Hoskins, mayor. Plans are being prepared by George S. Pierson, Mem. Am. Soc. C. E., Kalamazoo, Mich.

CONTRACTS TO BE LET.

Dunkirk, N. Y.—Sealed bids will be received until May 7 for a sewer. Cy. clk.

Kenton, O.—Sealed tenders are asked until May 15 for a sewerage system. F. E. Ray, secy.

Wilkesbarre, Pa.—Bids are asked until May 11 for brick or stone sewers. F. Deitrick, cy. clk.

Tampa, Fla.—Sealed bids are asked until June 30 for 2,350 ft. of 8 and 4-in. pipe sewers. W. B. Henderson, prest. B. P. W.

St. Paul, Minn.—Sealed bids were asked until May 6 for furnishing 1,650 ft. of 12-in. sewer pipe. Matt Gensen.

San Francisco, Cal.—Sealed bids are asked until May 6 for constructing a sewerage system at Fort Point, Cal. J. M. Marshall, Q. M.

Chester, Pa.—Sealed bids are asked until May 6 for constructing the Fourth-st. sewer. Frank W. Harrison, cy. clk.

Algona, Ia.—Bids are asked until May 11 for digging the uncompleted portions of public drain No. 1. M. P. Weaver, co. audt.

Canton, O.—Sealed bids are asked until May 4 for extending the Cassidy-st. storm water sewer. Phil H. Weber, cy. engr.

Toledo, O.—Sealed bids are asked until May 13 for constructing pipe sewers in certain alleys. J. C. Connell, cy. clk.

Crawfordsville, Ind.—Sealed bids are asked until May 20 for a system of sewers in numerous streets. E. S. Simpson, engr.

Perry, N. Y.—Bids are asked until May 6 for constructing a sewerage system consisting of 10 mis. of pipe sewers. Thos. H. Bussey, prest. bd. trustees.

Akron, O.—The work of construction of the Barberton Ditch in Barberton, O., will be sold at public outcry, May 11, in this city. J. A. Sisler, co. audt.

Pipestone, Minn.—Seals bids will be received until May 2 for building a sewerage system at the Pipestone school, Pipestone, Minn. W. A. Jones, com'r Indian affairs, Washington, D. C.

Washington, D. C.—Sealed bids are asked until May 6 for a sewerage system at the Southern Ute agency. W. A. Jones, com'r. Indian Affairs, Washington, D. C.

New Orleans, La.—Bids will be received July 3 for the completion of the Third-st. system, the St. Bernard system, the Nashville system, the Algiers system and the Lowerline system. Bd. Drainage com'r.

Havana, Cuba—Sealed bids will be received until May 29, (postponed from April 3), for a sewerage system. Lieut. W. J. Borden, corps of engrs., U. S. A., ch. engr., Havana; Alejandro Rodriquez, mayor.

Kenton, O.—Sealed bids are asked until May 7 for building sewers in North Kenton sewer district No. 1 with necessary outfall sewer and a disposal plant. W. E. Meyers, cy. engr.; John P. Dugan, cy. clk.

Boston, Mass.—Bids are asked until May 13 for constructing section 49, and culverts and embankments for sections 48 and 49, requiring 2,000 ft. of 135x150-in. sewer, with 325 ft. of 48 and 30-in. culverts, and 180,000 cu. yds. of filling. W. M. Brown, ch. engr. Met. Water & Sewerage Bd.

CONTRACTS AWARDED.

New Ross, Ind.—The contract for constructing a sewer on Main-st. was awarded to Wm. Mason.

Connellsville, Pa.—The contract for 12 mis. of sewer was awarded to J. B. Sheets & Co. of Pittsburg for $62,500.

Tacoma, Wash.—The contract for a new sewer in dist. No. 115 was awarded, April 16, to Mitchell & Co. for $5,837.50.

Cincinnati, O.—Thomas P. Strack secured the contract for the Bloody Run sewer for $18,119.

Helena, Ark.—The contract for a sewerage system was awarded, April 3, to Guild & Co. of Chattanooga, Tenn., for $55,132.

Hanford, Cal.—The contract for constructing a sewerage system was awarded to W. D. Trewhitt for $16,200.

Burlington, N. J.—A franchise for constructing a sewerage system, including 10 mis. of 8 to 20-in. sewers, has been granted Geo. Pfeiffer of Camden for $75,000.

Connellsville, Pa.—The contract for constructing 12½ mis. of pipe sewers, with 160 manholes, has been awarded to J. B. Sheets & Co. of Pittsburg for $52,970.

Des Moines, Ia.—The contract for building sewers in Buchanan-ave. and Twenty-eighth-st. was awarded, April 12, to O. P. Herrick at 93 4-5 cents a lin. ft.

Hartford, Conn.—The contract for building sewers in Orange and Arbor-sts. and the Boulevard was awarded, April 10, to the Hartford Paving and Construction company for $4,496.90.

Dedham, Mass.—The lowest bids received for constructing a sewerage system were as follows: Newman Construction company, Providence, R. I., section B $29,350, C $21,620, E $10,218, total $61,188; Frank A. Gammino, Providence, R. I., section A $11,201, D $6,525, total $17,726. There were 17 bidders on the work.

Little Rock, Ark.—The contract for constructing sewers in district No. 28 has been awarded to J. H. McCoppin of this city, as follows: 5,400 ft. 10-in. pipe at 98 cts.; 3,600 ft. 8-in. pipe at 61 cts.; 13,000 ft. 6-in. at 61 cts.; 56 manholes at $37; 16 flush tanks at $82; concrete at $6, and lumber at $15. The trench to average 10 ft. in depth.

Cohoes, N. Y.—William Stanton secured contracts, April 15, for sewers, as follows: Clinton-st., $481.25; Imperial-ave., $212.21; Lancaster-st., $312.53; New-st., $262.80; alley between Hudson and Maple-aves., $1,593.32; alley between Forest and Maple-aves., $2,862.79.

Newark, N. J. (Special).—Ernest Adam, engr. of dept. of streets and sewers, says that the contract for constructing the Central relief sewer was awarded, April 11, to B. J. Sullivan, 200 Broadway, New York, for $10,687.50.

New York City.—Bids were received April 17 for constructing a sewer in Broadway, borough of Queens, and for a sewage disposal plant in connection with the same. The bids, which include brick sewer, circular brick sewer, vitrified pipe sewer, 65 manholes, timber, work, concrete, etc., are as follows: Nassau Construction company, Brooklyn, N. Y., $222,688; P. F. Brennan, 721 E. 180th-st., $212,038. Each company bid $124,000 for the disposal plant, which is included in the above figures.

Cleveland, O.—Bids for sewers were received as follows: Axtell-st., John Potts & Co., $2,996; Trot-st., C. T. McCracken & Co., $4,701; Woodland Hills-ave., William Eggers, $5,845; Union-st., Beers & Doolittle, $1,615; Adelphia-st., C. F. Kuentz, $3,573; Cable-st., C. F. Kuentz, $3,414; East-ave., Reaugh Construction company, $2,671; Finn-

st., C. F. Kuentz, $2,831; Marble-st., Campbell Bros., $1,481; Sawyer-st., William J. Townsend, $2,627; Canal-st., C. F. Kuentz, $4,732; Frederick-st., William Lehman, $3,381; Lenox-st., Christian Burkhardt, $9,105; Marcelline-ave., Reaugh Construction company, $12,378; Parkview-ave., C. T. McCracken & Co., $1,689; Regent-st., Christian Burkhardt, $1,601; Robinson-ave., C. T. McCracken & Co., $1,328; Rockland-ave., Campbell Bros., $1,198; Rural-st., John Potts & Co., $2,958; Wright-st., Christian Burkhardt, $2,465.

WATER-WORKS.

Yonkers, N. Y.—The annual report for 1900 shows that on 4,968 services 4,852 water meters are used.

Belleville, N. J.—An ordinance increasing the water rates, to take effect May 1, passed two readings at a meeting of the Belleville township committee April 2.

Leavenworth, Kas.—The Leavenworth Water company will appeal to the United States Supreme court from the decision of the Kansas Supreme court requiring it to make annual statements of business to the city clerk.

Newtown, (L. I.) N. Y.—The Citizens' Water company of this city has absorbed the Wyckoff Heights Water company, a corporation supplying Wyckoff Heights with water, and will connect the mains of the two systems.

East Albany, N. Y.—James M. Caird, chemist and bacteriologist of Troy, N. Y., has been retained by the East Albany Water company of this city to conduct a series of chemical and bacteriological tests at their new filter plant.

Racine, Wis.—The water supply in the entire southern part of the First ward was cut off recently on account of the 14-in. water mains of the Racine Water company giving out. When examined it was found that electrolysis had completely ruined the pipe.

Jeffersonville, Ind.—Frank Schefold of New Albany is making an investigation of the water works system of this city, preliminary to the cancelling of the contract between the city and the water company. It is claimed that the report will show that the company has but 9 mis. of mains, while the contract calls for 10 mis., and that the company is not living up to its agreement regarding the pumping capacity of its plant.

CONTEMPLATED WORK.

Jacobs, Wis.—Surveys are being made for water works.

La Crosse, Wis.—A fund of $8,000 has been set aside for meters.

Cedar Falls, Wis.—A new water tank to cost $18,000 is contemplated.

Winona, Minn.—This city voted to extend the water works system.

Russell, Mass.—A water works system will probably be built by private parties.

Boise, Idaho.—The question of municipal water works will be voted on.

Webster, S. D.—Bonds for a water works system for fire protection have been approved.

Yankton, S. D.—The Business Men's club is urging the necessity of a water works system.

Evansville, Ind.—A new filter plant is contemplated by the water board. Trustees Grote and Brentano.

Seattle, Wash.—The question of extending the water mains of this city is being agitated.

Angelica, N. Y.—This city voted April 16 to expend $1,000 for water works repairs.

Redlands, Cal.—The question of purchasing the water works system will be voted on.

Marlboro, N. Y.—The Marlboro Water company contemplates improving the water works.

Lockport, N. Y.—The common council and taxpayers approved the $75,000 water supply act April 2.

Norristown, Pa.—Mains will probably be laid to Newcastle. A. E. H. Smith and W. J. Wilson interested.

Leon, Ia.,—Bids will probably be received about May 15 for laying 2,200 ft. of 4-in. mains, a pump, etc.

Greenwood, Ind.—This town voted April 4 to allow a company to build water works and electric light plant.

Rome, N. Y.—The board of water and sewer comns. have decided to call a special election to vote on the question of procuring a gravity water supply from Fish creek at a cost of $152,000.

Auburn, N. Y.—The water commissioners contemplate laying about 15,000 ft. of 6, 8 and 12-in. water mains this year.

Granite Falls, Minn.—This town voted to raise $6,000 bonds for extending their water works and electric light plant.

Marion, O.—The Marion Water company contemplates improving its works, including pumping machinery, etc. E. H. Cowan, mgr.

Green Bay, Wis.—The Green Bay Light and Power company contemplates between one and two miles of water mains extension. Mayor Mainland.

Sellersburg, Ind.—A committee has been appointed to secure information regarding water works. Frank Williams, secy. com.

Kansas City, Mo.—A resolution was adopted April 19 for constructing a 30-in. water main from Kaw point to Genesee-st.

Shreveport, La.—The council has demanded that the owners of the water works take steps at once to improve the water supply.

Northampton, Mass.—The water commissioners decided, April 16, to establish a new water supply system, at a cost of $300,000.

Lewiston, Idaho—The council will consider, May 6, the proposition of William H. Skinner for a twenty-five-year franchise for a water works system.

Sherman Heights, Tenn.—J. M. Stephens desires estimates for water works to supply this place and East Chattanooga, according to press reports.

Moline, Ill.—The water works system will be improved by the addition of water mains and a mechanical filter. D. W. Mead, cons. engr., Chicago. Mayor Wessel.

Pittsburg, Pa.—Plans for the proposed filter plant have been completed, and bids will be asked soon; estimated cost, $2,500,000. Geo. W. Wilson, dir, pub. wks.

Jasper, Minn.—Plans have been adopted for a water works system, and the question of issuing bonds will be voted on soon. S. B. Howe, engr. Sioux Falls, S. D.

Houston, Tex.—This city proposes to install new boilers with new wells for an increased water supply and otherwise improving the works of the Houston Water Works company.

Grand Rapids, Mich.—A resolution was adopted April 5 authorizing the city engineer to prepare plans and specifications for the improvement of the city water supply.

Horncllsville, N. Y.—The water commission voted to direct the council to issue $175,000 bonds for the purchase of the Hornellsville water works. Wm. Richardson, water com.

Rock Island, Ill.—G. G. Craig, jr., comr. of health, recommends that the intake pipe be relaid, the walls of the wells doubled, and that efforts be made to prevent the waste of water.

New London, Conn.—The construction of a new reservoir and about 3 mis. of 16 and 20-in mains is contemplated. Bids will be asked for laying the pipe. W. H. Richards, engr. water dept.

Huntsville, Ala.—The council has refused to renew the contract with the Dallas Manufacturing company to supply this city with water for another ten years, from May 1, 1902, on which date the contract expires.

Berwick, Me.—The Berwick Water company is reported as securing prices on pumps, standpipe, reservoir work, 4 to 10-in. pipe, specials, hydrants, valves, etc., for the proposed water works.

Spokane, Wash.—Plans for a water works system have been completed, and bids will be asked as soon as the question of issuing bonds is voted on, which will be in May. Otto A. Weile, cy. engr.

Akron, O.—The Akron Water Works company contemplates building a reservoir on the side of Sherbondy Hill, to have a capacity of 10,000,000 gals. The company will also add a new 10,000,000-gal. pump to its station.

Holgate, O.—This town voted to issue $15,000 bonds for water works and electric lights, and bids will be opened about June 1 for pumps, standpipe, etc. J. H. Smith, clk.

The question of issuing bonds for the construction of water works will be voted on as follows: De Smet, S. D.; Staunton, Va.; Watkins, N. Y.; Hopkinton, Ia.; Harmony, Minn.; Weston, Or.; Bakersfield, Cal.; Hensall, Ont.

The question of issuing water works bonds has been favorably voted on at the following places: Starke, Fla.; Grand Rapids, Wis.; Howard, S. D.; Cloquet, Minn.; Riceville, Ia.; Leon, Ia.; Sheridan, Me.; Lewes, Md.; Laurel, Miss.; Waco, Tex.

The construction of water works is contemplated at the following places: Spanish Fork, Utah; Abbeville, Ia.; Tully, N. Y.; Glidden, Wis.; Janesville, Minn.; Winterset, Ia.; McDonough, Ia.; Herington, Kas.; Wilbur, Wash.; Braidentown, Fla.; Eureka, Utah.

Niagara Falls, N. Y.—The La Salle Water company has been incorporated to build water works here. The company, it is reported, will offer to buy the present water works and to supply water from Lake Erie in this city and other nearby towns.

Cincinnati, O.—Plans and specifications have been submitted for the pumping house for the eastern pumping station. Two estimates were submitted—$119,998 and $126,692—the variance being in whether the building is to be constructed wholly of stone or of brick and stone combined.

Binghamton, N. Y.—The board of water commissioners has decided on a mechanical sand filter plant, American system, for the purification of the city water. The estimated cost is about $101,000. Secretary Anderson has been instructed to procure plans and specifications.

Newark, N. J.—Plans for a water storage reservoir have been submitted by M. R. Sherrerd, engineer of the water department. The reservoir is to be located at Cedar Grove, several miles northwest of this city, and just west of First Mountain. Three earth dams will be required. The estimated cost of the reservoir is $1,500,000.

Frackville, Pa.—(Special)—The water works system, or a part interest in it, is offered for sale to a party who will greatly improve it. If not sold the works will be improved by sinking an immense well 50 ft. in diameter and 35 ft. deep. John Haupt. Owing to an error in the April number of the magazine this item was given as Franklin, Pa.

Columbus, O.—S. M. Gray, M. Am. Soc. C. E., has recommended a new water supply and purification works for this city, at a cost of $3,800,000. The plan involves a high masonry concrete granite faced dam and impounding reservoir on the Scioto river, the development of water power there, a 60-in. steel conduit, a 20,000,000-gal. mechanical filtration and water softening plant, a 12,000,000-gal. clear water basin, a new pumping station, a reinforcement of the distribution system and the erection of three standpipes. Mr. Gray says it is not necessary to do all this work at once, but the portion recommended for immediate construction would cost about $2,200,000. He estimates that mechanical would be cheaper than slow sand filtration by $188,000 for first cost and $19,792 per year for operation, on a basis of 20,000,000 gals. a day; and that for both filtration and softening mechanical filtration is cheaper by $32,357 a year. The additional expense due to softening the water is estimated at $58,855 a year. Mr. Gray believes, however, that the people of Columbus are now paying $221,000 a year on account of hard water.

CONTRACTS TO BE LET.

Goshen, N. Y.—Bids are asked until June 1 for excavating a canal. H. J. Yerg, clk.

Cherryvale, Kas.—Sealed bids are asked until May 20 for constructing a dam and reservoir. S. G. Howard, cy. clk.

Jamestown, N. D.—Bids are asked until May 6 for sinking a 4½ or 6-in. artesian well. Geo. C. Eager, cy. audt.

Joliet, Ill.—Bids are asked until June 17 for improving and increasing the water supply. W. F. McMasters, cy. clk.

Cincinnati, O.—Sealed bids are asked until May 13 for furnishing water pipe, castings, etc. Geo. F. Holmes, clk. B. P. S.

Detroit, Mich.—Sealed bids are asked until May 8 for furnishing 36 and 42-in. iron pipe. Benj. F. Guiney, supt. water comm's.

Levis, Que.—Bids are asked until May 15 for constructing gravity works and a drainage system. F. E. Roy, secy. and treas.

Falmouth, Mass.—Bids are asked until May 2 for furnishing cast iron water pipe,

valves and hydrants. J. H. Crocker, chmn. comm's.

Cleveland, O.—Sealed bids are asked until May 11 for furnishing hydrants and water gates during 1901. Charles P. Salem, dir. pub. wks.

Dyersburg, Tenn.—Bids are desired until June 1 for a 20-yr. franchise for a water works and electric light plant. W. A. Fowlkes, jr., mayor.

Casper, Wyo.—Bids are asked until May 15, according to press reports, for furnishing 100 tons of 6-in. pipe and 5 tons of lead. E. B. Shaffner, clk.

Cohoes, N. Y.—Bids are asked until May 6 for furnishing 9,000 ft. 4 and 6-in. cast iron water pipe. Jas. Aitken, prest. bd. water com's.

St. Louis, Mo.—Sealed bids are asked until May 7 for steam and feed water piping at Baden pumping station. Robt. E. McMath, prest. B. P. I.

Marquette, Mich.—Sealed bids are asked until May 29 for laying a 42-in. steel riveted intake pipe. F. W. Cappelen, cons. engr., Chicago; J. P. Kern, secy. bd.

Middlebury, Vt.—Sealed bids are asked until May 7 for laying 7 mis. of 6-in. mains to a new source of water supply. Prof. E. C. Bryant, secy. water com.

Yonkers, N. Y.—Bids are asked until May 2 for removing the old boiler and setting and building a new boiler at the low level service station. J. C. Shotts, prest.

Arapaho, O. T.—Bids are asked until May 13 for constructing water works at the Cheyenne and Arapaho Indian Agency, Okla. W. A. Jones, Indian com'r, Washington, D. C.

Dubois, Pa.—Bids are asked until May 21 for a water supply system, consisting of a dam, gate house, one tunnel, 3,450 feet long, and 7 1-3 miles of 20 and 16-inch pipe lines, with other appurtenances. W. A. Engleman, chm. water com.

Cincinnati, O.—Sealed bids are asked until June 18 for furnishing three self-contained, vertical, triple-expansion, crank and fly wheel pumping engines of 25,000,000 gals. capacity and three of 12,000,000 gals. capacity, an electric crane of 30 tons capacity boilers adequate in capacity for the operation of the six engines and their appurtenances. Aug. Hermann, prest. bd. trustees comr's W. W.

CONTRACTS AWARDED.

New Iberia, La.—Lewman & Co. of Louisville, Ky., secured the contract for building water works for this place.

Urbana, Ill.—The contract for a new reservoir at the pumping station was awarded to T. E. Taniton of Springfield for $5,000.

Ocean City, Md.—The contract for constructing water works and sewers has been awarded to Rosser & Castoe of Bellaire, O., for $12,999.

Syracuse, Ind.—The contract for constructing water works was awarded to the C. L. Olds Construction company of Ft. Wayne, Ind., for $14,358.

Philadelphia, Pa.—The contract for constructing the upper Roxborough filtration plant and the necessary pipe line has been awarded to D. J. McNichol of this city for $1,300,000.

BRIDGES.

Dover, Del.—Bids are asked until May 7 for building a bridge over Silver Lake. Walter S. Davis, cy. clk.

Fonda, N. Y.—The county supervisors voted April 12 to build a new free bridge across the Mohawk river at Ft. Hunter.

New Castle, Ind.—Sealed bids are asked until May 7 for building seven steel bridges. Co. com's.

Calhoun, Ga.—Bids are asked until June 5 for building an iron and steel bridge across the Coosamattee river.

Terre Haute, Ind.—The Vigo county commissioners have decided to build a new iron bridge across the Wabash river.

Bangor, Me.—Sealed bids are asked until May 13 for erecting an iron bridge. B. H. Coombs, cy. engr.

Buckingham C. H., Va.—Bids are asked until May 15 for a new steel bridge over Hunt's creek. Wm. Peile, rd. engr.

Brookings, S. D.—Bids will be received until May 15 for four steel bridges. J. Alton, co. audt.

Clarksdale, Miss.—Sealed bids are asked until June 3 for a steel bridge across Sunflower river. W. J. Bouldin, clk.

Vincennes, Ind.—Sealed bids are asked until May 13 for erecting 16 steel highway bridges. J. S. Spiker, engr.

Toronto, S. D.—Bids are asked until May 20 for erecting a bridge in Bloom twp. O. H. Quickstad, town clk.

Holyoke, Mass.—(Special)—Jas. L. Tighe, cy. engr., says plans are being drawn for a wooden bridge to be built across the canal at Bridge-st.

Chicago, Ill.—Sealed bids are asked until May 8 for building the substructure and superstructure of a bridge across the Chicago river. Alex. J. Jones, pres. bd. trustees. Sanitary dist.

Youngstown, O.—Bids are asked until May 11 for the stone work for McGuffy-st. bridge. Marcus Waterman, chmn. co. comm.

Warsaw, Ind.—Sealed bids are asked until May 8 for building two steel bridges and two stone arches. W. Y. Chamberlain, cy. engr.

Williamsport, Ind.—Bids are asked until May 7 for four small highway bridges. Norton C. Andrews, engr.

Batesville, Miss.—A new bridge will be erected over the Tallahatchie river at Panola to replace the one that collapsed recently. Bd. co. supvr.

Ft. Collins, Ark.—Sealed bids are asked until May 5 for building a combination bridge across Big Thompson river in Estes Park. H. E. Tedmon, co. clk.

Nashville, Tenn.—A steel drawbridge will be erected over Paint Rock river at New Hope by Madison and Marshall counties.

Carrollton, Mo.—Sealed bids are asked until May 7 for erecting five bridges. Silas Ballard, bridge com'r.

Grafton, N. D.—Bids are asked until May 8 for iron and steel bridges. O. M. Fraser, co. audt.

Vidalia, La.—Sealed bids are asked until May 8 for building three steel bridges. Jas. P. Eagan, prest. Police Jury, Concordia Parish, La.

Dublin, Ga.—A. R. Anau, Wm. Kea and J. M. Blackshear have been appointed a committee to receive plans and specifica-

tions for the proposed extension of the Oconee river bridge. Bids will be asked soon.

Dunkirk, N. Y.—Sealed bids are asked until May 7 for building iron bridges over Douglass creek at E. Pine and N. Beagle-sts., cy. engr.

Akron, O.—Bids will probably be asked in May for a Melan arch bridge across the Ohio canal, at Falor-st. J. W. Payne, cy. engr.

Indianapolis, Ind.—Sealed bids are asked until May 14 for constructing bridges over Goose creek, near West Newton; McGuires' creek, Decatur twp.; Dollarhide creek, Decatur twp. Jas. E. Green, chmn. co. com.

PARKS.

Helena, Mont.—Plans for the improvement of the public parks are being considered by the council.

Chicago, Ill.—Unimproved lots and plats of ground which are the property of the city are to be temporarily utilized as small parks and public play grounds.

Abilene, Kas.—The question of establishing a public park is being considered. A. B. Rose, E. H. Forney and F. L. Ball have been appointed a committee to select a site.

STREET LIGHTING.

Johnstown, Pa.—The council will appropriate $20,000 for lighting the city for one year.

Hubbard, O.—The municipal electric light plant was destroyed by fire recently.

Dayton, Wash.—The advisability of purchasing the city electric light plant is being considered.

Montpelier, O.—The council has decided to issue $6,000 bonds for extending the electric light and water works plant.

Blenheim, Ont.—Bids are asked until May 2 for erecting a light plant. John Nicholl, fire, water and lgt. com.

Mansfield, O.—Sealed bids are asked until May 11 for lighting this city for two years from July 1, 1901. F. M. Remy, cy. clk.

Brazil, Ind.—This city contemplates building a municipal electric light plant.

Rock Hill, S. C.—The question of issuing $55,000 bonds for purchasing the plants of the Rock Hill Water, Light and Power company will be voted on.

Washington, D. C.—Sealed bids are asked until May 6 for a gas machine house and acetylene gas machine fixtures. W. A. Jones, Indian com., Washington, D. C.

Fond du Lac, Wis.—The business men have organized a stock company for the purpose of establishing a new electric lighting plant.

Los Gatos, Cal.—An ordinance has been passed providing for an expenditure of $10,000 for an arc light system.

Hedrick, Ia.—The city council passed an ordinance providing for the construction of a gas plant at a cost of $5,000.

Oxford, Mass.—A committee has been appointed to investigate the question of lighting the streets with electricity. E. S. Pease, twn. clk.

Melrose, Mass.—Sealed bids are asked until May 15 for lighting the streets of this city. W. Dobney Hunter, engr. and supt. pub. wks.

Pottsville, Pa.—Bids are asked until June 4 for lighting the borough for 5 or 10 years from Feb. 15, 1902. G. A. Berner, town clk.

Reading, Mich.—Sealed bids are asked until May 14 for erecting a municipal lighting plant. Glen E. Stowe, vil. clk.

El Paso, Tex.—Sealed bids are asked until June 1 for lighting this city for 5 years, from June 1, 1902. S. G. Peticolas, cy. electrician.

Sullivan, Ind.—Bids are asked until May 2 for lighting the city for 5 or 10 years, from Jan. 1, 1902. David Crawley, clk.

Bangor, Me.—The committee of street lighting has been authorized to secure bids for a municipal lighting plant, to cost about $47,000.

The question of issuing bonds for building electric light plants will be voted on as follows: Mansfield, O., May 6; Covington, Ga., May 1; Kissimmee, Fla., Geneva, O., May 11.

Glenwood Springs, Col.—An ordinance has been adopted providing for the issue of $30,000 bonds for the construction of an electric light plant.

Electric light plants are contemplated at the following places: Burlingame, Kas.; Neponset, Ill.; Harrisburg, Va.; Medford, O. T.; Roanoke, Ala.; Manchester, Vt.; Winchester, Tenn.; New Ulm, Minn.

The question of issuing bonds for electric light plants has been favorably voted on at the following places: Butler, Mo.; Tullahoma, Tenn.; Fairfield, Ia.; Dunkirk, O.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Montclair, N. J.—This town voted $5,500 for garbage collection.

Cann for $2,200.

Jamestown, N. Y.—Mayor Johnson recommends the erection of a garbage crematory in his annual message.

Washington, Pa.—An ordinance has been passed dividing this borough into four districts for street cleaning.

Racine, Wis.—The contract for sprinkling State-st. was awarded April 13 to A. H. Allen at 12½ cts. a lin. ft.

Dayton, O.—Specifications for a garbage crematory are being prepared by F. M. Turner, cy. engr., and bids will be asked soon.

Atlanta, Ga.—Sealed bids are asked until May 10 for the reception and disposal of the garbage, night soil, etc., for one year. Dr. B. W. Bizzell, 114½ Peachtree-st.

Madison, Wis.—The council will let three contracts for collecting garbage, waste, etc. the citizens to provide their own metal receptacles. Alderman Sparling, interested.

Columbus, O.—An ordinance has been introduced authorizing the director of public improvements to purchase or rent the necessary tools and machinery for cleaning, sweeping and sprinkling the streets. The sum of $5,000 is provided for this purpose.

TOO LATE FOR CLASSIFICATION

Ozark, Ark.—Bids are asked until May 8 for two steel bridges. W. M. Qualle, co. comr.

Cohoes, N. Y.—Bids are asked until May

7 for the removal of garbage. Wm. J. Ellcott, cy. clk.

Wabash, Ind.—Bids are asked until May 27 for improving Wilson-st. Robt. P. Woods, cy. engr.

Bangor, Me.—Bids are asked until May 13 for a span iron bridge. C. C. Porter, st. engr.

Lansdowne, Pa.—Bids are asked until May 3 for cement walks during 1901. H. L. Warren, engr.

Binghamton, N. J.—Bids are asked until May 14 for electric lighting, according to press reports.

Carver, Minn.—Bids are asked until May 6 for two stone arch bridges. Oswald C. Brunius, vil. rec.

Watertown, N. Y.—The board of water commissioners have decided in favor of installing a filtration system.

Wabash, Ind.—Plans are being adopted for a sewer for the Charley Creek district. Robt. P. Woods, cy. engr.

Minnesota, Minn.—Sealed bids are asked until May 15 for a water works system. M. E. Drake, vil. rec.

Dunkirk, N. Y.—Sealed bids are asked until May 7 for a sewer in Eagle-st. Jas. P. Morrison, cy. engr.

Blakely, Ga.—A committee has been appointed to make ac ontract for constructing water works and electric light plant.

New Orleans, La.—Bids are asked until May 3 for paving a portion of Canal-st. with asphalt. V. Tujague, compt.

Redfield, S. D.—Sealed bids are asked until June 3 for sewers on Emerson-st. and Franklin-ave. J. S. Huston, cy. audt..

Dunkirk, N. Y.—Bids are asked until May 7 for two iron bridges across Douglass creek. James P. Morrisey, cy. engr.

South Bend, Ind.—Sealed bids are asked until May 14 for 7,000 sq. yds. of brick pavement on W. Navarre-st. A. J. Hammond, cy. engr.

Mercer, Pa.—Bids are asked until May 13 for stone work on several bridges, and for three stone arches. L. H. Miller, clk. co. com's.

Morristown, N. J.—Sealed bids are asked until May 14 for acadamizing numerous roads. Henry M. Darlymple, dir. bd. chosen freeholders.

Clarksdale, Miss.—Sealed bids are asked until May 7th for an electric light plant. W. D. Barry, chmn. w w & elect. lgt. com.

Alexandria, Ind.—Sealed bids are asked until May 20th for paving certain alleys with vitrified brick. J .S. Humphrey, cy. engr.

Missoula, Mont.—Sealed bids are asked until May 6 for 6,200 ft. of 4-in. water pipe with valves and connections. W. F. Hughes, cy. clk.

Scranton, Pa.—Bids are asked until May 2 for a sewerage system consisting of 6,750 ft. of 8 to 18-in. pipe. Joseph P. Phillips, cy. engr.

Cleveland, O.—Sealed bids are asked until May 11 for a steel bridge across Rocky river, in Strongsville twp. Julius C. Dorn, clk. bd. co. com's.

Ridgefield Park, N. J.—Sealed bids are asked until May 6 for building sewers and drains in numerous streets. Geo. J. Smith, clk. bd. trustees.

Cincinnati, O.—Bids are asked until May 23 for keeping in repair for one year the asphalt pavement on Race-st. Geo. J. Holmes, clk. B. P. S.

Racine, Wis.—The residents on Milwaukee-ave. desire brick paving instead if macadam.

Boston, Mass.—Bids are asked until May 13 for constructing Mattapan bridge and approaches, Blue Hills parkways, Boston and Milton. Wm. T. Pierce, engr. Met. Park Com'n.

Elmira, N. Y.—Bids are asked until May 4 for 10,000 sq. yds. of asphalt paving and 7,000 lin. ft. of sandstone curbing on Market and Lake-sts. C. W. Wyckoff, cy. clk.

Lafayette, Ind.—Sealed bids are asked until May 15 for furnishing one pumping engine of 6,000,000 gals. and two pumping engines for 1,000,000 gals. Geo. E. Fiehmeyer, chmn. trustees.

Glens Falls, N. Y.—Sealed bids are asked until May 6 for 5,000 ft. of 6 and 2,000 ft. of 4-in. cast iron water pipe. Geo. P. Slade, vil. engr.

Atlanta, Ga.—Sealed bids are asked until May 16 for furnishing and delivering about 113,300 ft of water pipe and valves, specials, hydrants, lead and yarn. Park Woodward, supt. w. w.

Chester, Pa.—Bids are asked until May 6 for cleaning the streets, and for the removal and disposal of garbage, dead animals, etc., during 1901. W. I. Cullis, chmn. st. com.

Westchester, Pa.—Sealed bids are asked until May 4 for 3,774 ft. of sewer pipe of various sizes, and for digging trench, laying pipe and filling trench. Fred Heed, chmn. st. com.

Chicago, Ill.—Sealed proposals are asked until May 8 for paving Michigan-ave., from Jackson to Congress-st. and from Sixteneth to Eighteenth-st. with asphalt. E. G. Shumway, secy. South Park com's.

Gleenville, O.—Sealed bids are asked until May 21 for a settling basin and appurtenances in the sewage disposal works, and for sewers and appurtenances in Elbert-st. and Robinson-ave. Ira C. Farley, vil. clk.

West Newton, Mass.—Sealed bids are asked until May 13 for 69,000 ft. of sewer pipe with bends, branch connections and stoppers. Also for building 2 sections of sewer in Rock Tunnels at Hemlock George. Street com'r.

Pottsville, Pa.—Sealed bids are asked until May 7 for furnishing terra cotta sewer pipe and fittings, machine broken trap rock, furnace slag or stone or hard broken stone, and furnishing and laying curbing guttering, stone street crossings and brick sidewalks. G. A. Berner, town clk.

Danville, Ky.—Sealed bids are asked until May 2 for constructing a sewerage system, consisting of 8,700 ft. of 10-in., and 23,300 ft. of 8-in. tile sewers, 130 manholes, 16 flush tanks and 3 septic tanks. J. B. Fisher, chmn. sewer com.; Alvord & Shields, engrs.

Philadelphia, Pa.—Legal proceedings were begun April 18 to restrain the execution of asphalt contracts between this city and the Vulcanite Paving company, the Pennsylvania Asphalt Paving company, the Richardson & Ross Asphalt Paving company and the Alcatraz Paving company. The complainants are Warner-Quinlan.

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